3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the General Analysis Area that includes all five of the five LBA[1] tracts. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected. Figure 3-1 shows the General Analysis Area for most environmental resources.

> Additional, more detailed site-specific information about the affected environment for the study area identified for each LBA tract is contained in a separate document entitled *Supplementary Information on the Affected Environment in the General Analysis Area for the South Powder River Basin Coal Lease Applications EIS*, which is available on request.

The study area for each tract includes the tract as applied for, the adjacent lands that BLM is considering adding to each tract, and the anticipated permit amendment study area for each applicant mine. The anticipated permit amendment study area is defined as those lands adjacent to and outside of an applicant mine's current permit area that the applicant anticipates would be contained within the amended mine permit area, to include the new federal coal lease.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the Proposed Actions or action alternatives include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, floodplains, wild and scenic rivers, and wilderness) are not present in the project area and are not addressed further. In addition to the critical elements that are potentially present in the General Analysis Area, this EIS discusses the status and potential effects of mining each LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

3.1 General Setting

The General Analysis Area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie. The climate is semi-arid, with an average annual precipitation at Wright (Figure 1-1) of just over 11 inches (Martner 1986). June (2.35 inches) and May (2.04 inches) are the

[1] Refer to page xii for a list of abbreviations and acronyms used in this document.

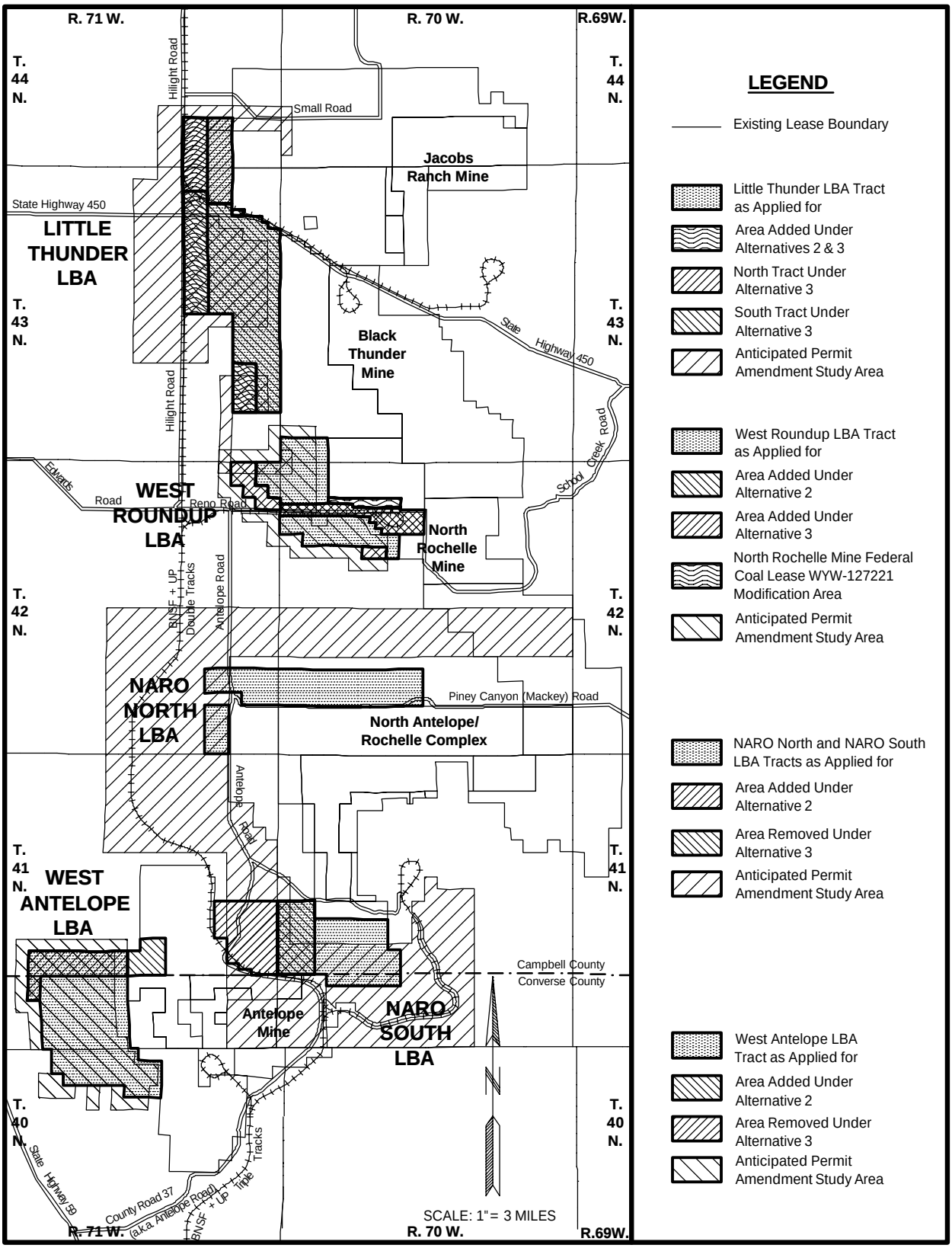

Figure 3-1. General Analysis Area.

wettest months, and February (0.29 inch) is the driest. Snowfall averages 25.1 inches per year, with most occurring in March (5.0 inches) and December (4.5 inches). Potential evapotranspiration, at approximately 31 inches (National Oceanic and Atmospheric Administration 1969), exceeds annual precipitation. The average daily mean temperature is 44.2 degrees F. The highest recorded temperature was 103 degrees F and the lowest was minus 34 degrees F. July is the warmest month, with a mean daily temperature of 70 degrees F, and January is the coldest (20.5 degrees F). The frost-free period is 100-125 days.

In the General Analysis Area, the regional wind speeds average from nine to 13 mph with local variations in speed and direction due to differences in topography. Wind speeds are highest in the winter and spring and are predominantly from the northwest or southeast. Wind velocity tends to increase during the day and decrease during the night. Winter gusts often reach 30-40 mph. During periods of strong wind, dust may impact air quality across the region. There are an average of 15 air-stagnation events annually in the PRB with an average duration of two days each (BLM 1974).

3.2 Topography and Physiography

The General Analysis Area is a high plains area within the eastern portion of the PRB. The PRB is bounded by the Black Hills on the east; the Big Horn Mountains on the west; the Hartville Uplift, Casper-Arch, and Laramie Mountains on the south; and the Miles City Arch and the Yellowstone River on the north. Landforms of the area consist of a dissected rolling upland plain with low relief, broken by low red-capped buttes, mesas, hills, and ridges. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. Elevations in the PRB range from less than 2,500 ft to greater than 6,000 ft above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the area are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The General Analysis Area and its tributaries are drained by the Cheyenne River. Elevations range from about 4,500 ft to 5,000 ft above sea level. Slopes in the General Analysis Area range from flat to greater than 50 percent. In the individual LBA tracts, the average slopes range from one to five percent.

3.3 Geology

Stratigraphic units in the General Analysis Area that would be impacted if the tracts under consideration for leasing are mined include, in descending order, recent (Holocene age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds). Variations between the LBA tracts occur primarily in the thickness of the mineable coal seams, the thickness of overburden, the parting

thickness(es) between the various seams comprising the Wyodak coal seam and the surface topography. Figure 3-2 is a chart showing the stratigraphic relationships of the surface and subsurface geologic units in the General Analysis Area. Surficial deposits in the General Analysis Area include alluvial and eolian deposits, clinker, and weathered Wasatch and Fort Union Formations. Although clinker is present throughout the General Analysis Area, the NARO South LBA Tract is the only LBA tract analyzed in this EIS that contains appreciable amounts of clinker. There are thin alluvial deposits along ephemeral streams and closed basin drainage channels. These alluvial deposits typically consist primarily of poorly to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. The valley floors of Porcupine Creek and Antelope Creek contain appreciable amounts of alluvium both in width and depth. The alluvial deposits in Porcupine Creek and Antelope Creek contain much more coarse-grained material (sands and gravels) than the ephemeral tributaries that drain most of the General Analysis Area.

The Eocene Wasatch Formation forms most of the overburden on top of the recoverable coal seams in the General Analysis Area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. Overburden thicknesses in the tracts under consideration for leasing range from around 110 ft to more than 300 ft. The overburden is relatively thin in the NARO South and West Antelope LBA Tracts and relatively thicker in the NARO North, Little Thunder, and West Roundup LBA Tracts.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (Figure 3-2).

The Tongue River Member of the Fort Union Formation consists of interbedded claystone, silty shale, carbonaceous shale, and coal, with lesser amounts of fine-grained sandstone and siltstone.

Within the General Analysis Area there are up to four mineable coal seams. The nomenclature of these seams varies from mine operator to mine operator. The U.S. Geological Survey (Flores et al. 1999) refers to the thick mineable coals in the Gillette coal field as the Wyodak-Anderson coal zone of the Tongue River Member of the Fort Union Formation. Locally these beds are referred to as Wyodak, Wyodak-Anderson, Anderson, and Canyon. The number of mineable coal seams varies from tract to tract. There is

Geologic Unit			Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE			Typically fine grained and poorly sorted in ephemeral drainages with occasional very thin, clean interbedded sand lenses. More laterally extensive, thicker, and coarse-grained along intermittent Antelope Creek and ephemeral to intermittent Porcupine Creek. Excessive dissolved solids generally make these aquifers unsuitable for domestic, agricultural and livestock usage. Low infiltration capacity in ephemeral draws unless covered by sandy eolian blanket. Low to moderate infiltration along Antelope Creek and Porcupine Creek.
CLINKER HOLOCENE TO PLEISTOCENE			Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting and partial fusing of overburden above the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated.
WASATCH FORMATION EOCENE			Lenticular fine sands interbedded in predominantly very fine grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch formation generally does not meet Wyoming Class I drinking water standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality which does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER	W — A / C	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use.
	LEBO MEMBER		The Lebo member, also referred to as "The Lebo Confining Layer" or "Lebo Shale" has a mean thickness of 711 feet in the PRB and a thickness of about 400 feet in the vicinity of Gillette (Lewis and Hotchkiss 1981). The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm (Lewis and Hotchkiss 1981).
	TULLOCK MEMBER		The Tullock member has a mean thickness of 785 feet in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
UPPER CRETACEOUS	LANCE FORMATION		Sandstone and interbedded sandy shales and claystone provide yields generally of less than 20 gpm. Higher yields are sometimes achieved where sand thicknesses are greatest. Water quality is typically fair to good.
	FOX HILLS SANDSTONE		Sandstone and sandy shales yield up to 200 gpm, however, yields are frequently significantly less. The water quality of the Fox Hills is generally good with TDS concentrations commonly less than 1000 mg/l.
	PIERRE SHALE		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.
W = WYODAK COAL; A = ANDERSON COAL; C = CANYON COAL			

Figure 3-2. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

one mineable seam in the West Roundup LBA Tract (Wyodak); two mineable coal seams in the NARO North and NARO South LBA Tracts (referred to by the operator as the Wyodak-Anderson 1 and 2); three mineable coal seams in the Little Thunder LBA Tract (referred to by the operator as the Upper, Middle, and Lower Wyodak); and four mineable seams in the West Antelope LBA Tract (referred to by the operator as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon). Interburden between the coal seams varies from 0 to around 100 ft.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the tracts under consideration for leasing, the heating value of the coal seams is expected to range from 7,850 to 9,130 Btu/lb. The ash content in the coal seams is expected to vary from 4 to 14 percent, the sulfur content from 0.1 to 0.6 percent, the fixed carbon from 30 to 41 percent, and the moisture content from 22 to 29 percent.

The Lebo Shale and Tullock Members of the Fort Union Formation underlie the Tongue River Member (Figure 3-2). They consist primarily of sandstone, siltstone, mudstone, shale, and coal. In general, the Tullock Member contains more sand than the Lebo Shale Member.

3.3.1 Mineral Resources

The PRB contains large reserves of fossil fuels including oil, natural gas (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (WSGS 2003b).

Coal

There are 15 coal mines lying along a north/south line that parallels Highway 59, starting north of Gillette, Wyoming and extending south for about 75 miles (Figure 1-1). These mines are located where the Wyodak coal is at its shallowest depths, i.e., nearest the outcrop. A 16th mine, the Dave Johnston Mine, located near Glenrock, Wyoming about 30 miles southwest of the Antelope Mine, has shut down coal mining operations.

Oil and Gas

Oil and conventional (i.e., non-CBM) gas have been produced in the PRB for more than 100 years from reservoir beds that range in age from Pennsylvanian to Oligocene (De Bruin 1996). There are approximately 500 fields that produce oil and/or natural gas. The estimated mean amounts of undiscovered hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion ft^3 of recoverable, non-CBM gas (USGS 1995). Depth to gas and oil-bearing strata are generally between 4,000 ft and 13,500 ft, but some wells are as shallow as 250 ft.

The LBA tracts overlie geologic structures that contain producible quantities of oil and gas. A portion of the Little Thunder LBA Tract is over the Hilight Oil and Gas Field, which was discovered in 1969. The main zone of production at the Hilight Field is the Early Cretaceous Muddy Sandstone which lies approximately 9,000 ft below the surface in this area. The western edge of the West Roundup LBA Tract overlies a portion of the House Creek Oil and Gas Field, which produces from the Parkman Sandstone of the Upper Cretaceous Mesaverde Group. The Parkman Sandstone is approximately 6,400 ft below the surface in the vicinity of the West Roundup LBA Tract. The western portion of the NARO South LBA Tract overlies both the Porcupine and House Creek Oil and Gas Fields. The Porcupine Field produces from the Upper Cretaceous Parkman, Sussex, and Turner Sandstones and the Niobrara Shale, also Upper Cretaceous in age. The Porcupine Field also produces from the Lower Cretaceous Muddy and Dakota Sandstones (De Bruin 1999). See Section 3.11 for further discussion of producing wells and their associated facilities.

Coal Bed Methane

The generation of methane gas from coal beds occurs as a natural process. Methane generated in the coal may be trapped there by overburden pressure, by the pressure of water in the coal, or by impermeable layers immediately above the coal. Deeper coal beds have higher pressures and generally trap more gas. Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal beds, and this seems to be the case in the PRB. Without the existence of conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that an appreciable quantity of methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively shallow coal burial depths. However, a large amount remains in the coal. One study estimates that there are approximately 38.2 trillion ft^3 of CBM gas in place in coal beds that are thicker than 20 ft and deeper than 200 ft. This study estimates that there are 25.6 trillion ft^3 of recoverable CBM reserves (Finley and Goolsby 2000).

Historically, methane has been reported flowing from shallow water wells and coal exploration holes in parts of the PRB. According to De Bruin and Jones (1989), most of the documented historical occurrences have been in the northern PRB. Olive (1957) references a water well in T.54N., R.74W. that began producing gas for domestic use in 1916.

CBM has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, west of the Eagle Butte Mine. CBM exploration and development is currently ongoing throughout the PRB in Wyoming. The predominant CBM production to date has occurred from coal beds of the Wyodak - Anderson zone in seams

known as the Anderson, Canyon, Wyodak, Big George, and other locally-used names. These are the same (or equivalent) seams that are being mined along the eastern margin of the basin by the mines that are included in this analysis.

CBM is being produced from other, deeper seams locally throughout the PRB. The only CBM well completions within the General Analysis Area to date have been within the Wyodak - Anderson coal seams. Coal mining does not directly affect production of CBM from coal seams below the Wyodak-Anderson, however, it does delay any proposed CBM development in the deeper seams in order to avoid interference with mining.

The presence of splits in the coal seams affects potential CBM development. Current CBM well completion practices within the PRB generally preclude completion of two seams separated by thick shales within a single wellbore. As a result, in the areas where the coal seams are split, two wells would be required to produce essentially the same reserve that would be produced from a single well in a single contiguous seam.

Since the early 1990s, the BLM has completed numerous EAs and three EISs analyzing CBM projects. The most recent of these is the *Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project,* referred to as the Wyoming PRB Oil and Gas EIS (BLM 2003a). That EIS covers almost 12,500 square miles, encompasses almost the entire PRB in all or parts of Campbell, Converse, Johnson, and Sheridan Counties, and covers both private and public (state and federal) lands. It analyzes the potential impacts of CBM development in the Wyoming PRB. The analysis in the Wyoming PRB Oil and Gas Project EIS assumes that approximately 39,400 new CBM wells would be drilled, completed, and produced over the next ten years, in addition to the more than 12,000 CBM wells that had been drilled or are permitted for drilling when the EIS was prepared. The EIS also analyzes the impacts of developing 3,200 new conventional oil and gas wells, constructing, operating, and reclaiming various ancillary facilities needed to support the new wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors by the end of 2011 (BLM 2003a).

When the Draft SPRB Coal EIS was prepared, only the Little Thunder LBA Tract included CBM wells that were producing. As of October 2003, producing CBM wells were also present on the West Roundup and NARO North LBA Tracts, under the Proposed Action and/or Preferred Alternatives for those tracts. There is CBM drilling and production activity in the area of the NARO South and West Antelope LBA Tracts, but no wells are currently producing in the area included under the Proposed Action or Preferred Alternatives for these tracts. Approved spacing for CBM wells is one well per 80 acres or eight wells per section. A maximum of 243 CBM wells could be drilled on all of the LBA tracts under the largest

alternative tract configurations being analyzed in this EIS. The ownership of oil and gas resources in the LBA tracts and the existing oil and gas (conventional and CBM) drilling in the area are discussed in Section 3.11 of this EIS.

Bentonite

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including cat litter and drilling mud. No mineable bentonite reserves have been identified on any of the proposed LBA tracts.

Uranium

There are substantial uranium resources in southwestern Campbell and northwestern Converse Counties. Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. A decreased demand combined with increased foreign supply reduced uranium mining activities in the early 1980s. There are currently two in-situ uranium recovery sites in the PRB (WSGS 2003b). Production at a third ended in 2000. No known uranium reserves exist on the LBA tracts.

Scoria

Scoria or clinker is present in the General Analysis Area and has been and continues to be a major source of aggregate for road construction in the area. Only the NARO South LBA Tract contains scoria. No scoria from the NARO South LBA Tract has ever been sold for use as an aggregate for road construction or any other uses.

A search of the BLM mining claim index revealed that no mining claims are presently located within the General Analysis Area.

3.4 Soils

Numerous baseline soil surveys associated with surface mining operations and oil field development have been conducted in the General Analysis Area. Soil surveys of Campbell and Converse Counties, Wyoming, including the General Analysis Area, have also been conducted by the NRCS. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's alternative tract configurations, and the applicant mine's anticipated permit amendment study area.

Soils within the LBA study areas were identified by series, which consist of soils that have similar horizons in their profile. Horizons are soil layers having similar color, texture, structure, reaction, consistency, mineral and chemical composition, and arrangement in the profile.

Soils vary depending upon where and how they were formed. Major factors

involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Three primary transportation processes causing three different soil types were noted: 1) those soils developed predominantly in alluvial or colluvial fan deposits, 2) those soils developed predominantly in residuum on uplands, and 3) those soils developed predominantly in eolian sand deposits. The major soil series encountered within the General Analysis Area were grouped according to the primary transportation processes and are listed as follows:

Soils developed predominantly in alluvial or colluvial fan deposits

Arvada
Absted
Bahl
Bankard
Bidman
Bone
Briggsdale
Cambria
Clarkelen
Decolney
Dillingson
Draknab
Felix
Forkwood
Fort Collins
Glenberg
Heldt
Haverdad
Haverson
Hiland
Hilight
Kishona
Lawver
Lithic Usti
Lohmiller
Openay
Parmleed
Pugsley
Rauzi
River Wash
Savageton
Shingle
Silhouette
Taluce
Teckla
Turnercrest
Ulm
Wags
Zigweid

Soils developed predominantly in residuum on uplands

Bowbac
Cushman
Gateson
Gullied land
Hiland
Hilight
Keeline
Parmleed
Razor
Renohill
Samday
Shingle
Savageton
Samsil
Sear
Taluce
Tassel
Terro
Thedalund
Theedle
Tullock
Turnercrest
Ustic Torrifluvent
Wags

Soils developed predominantly in aeolian sand deposits

Delconey
Dwyer
Embry
Maysdorf
Nomil
Orpha
Pugsley
Rauzi
Turnercrest
Vonalee

The baseline soil studies of the LBA study areas indicate that the amount of suitable topsoil which would be available for redistribution on all disturbed acres during reclamation would vary from an average depth of 1.5 ft to an average depth of 3.3 ft.

3.5 Air Quality and Climate

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along

valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

3.5.1 Topography

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors that affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperatures decrease and precipitation increases with increasing elevation.

The General Analysis Area, shown in Figure 3-1, is located in the southern portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys, canyons, and buttes). Elevations range from about 4,500 ft to 5,000 ft above sea level.

3.5.2 Climate and Meteorology

The general climate is typical of a semi-arid high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. The climate in the General Analysis Area is semi-arid, with an average annual precipitation at Wright of just over 11 inches (Martner 1986). Snowfall averages 25.1 inches per year, with most occurring in March and December. Evaporation exceeds annual precipitation, with relatively short warm summers and longer cold winters. The average daily mean temperature is 44.2 degrees F. The highest recorded temperature within the General Analysis Area was 103 degrees F and the lowest was minus 34 degrees F. July is the warmest month, with a mean daily temperature of 70 degrees F, and January is the coldest (20.5 degrees F). The frost-free period is 100-125 days.

Winds are greatly affected by local topographic features. In the General Analysis Area, the regional wind speeds average from nine to 13 mph with local variations in speed and direction due to differences in topography. Winds are predominantly from the northwest or southeast and tend to be strongest in the winter and spring and calmer in the summer. Wind velocity tends to increase during the day and decrease during the night. The air quality and meteorological sampling locations and associated wind rose diagrams for the North Antelope/Rochelle Complex and Black Thunder, North Rochelle, and Antelope Mines are shown in Figures 3-3 through 3-6.

3.5.3 Regulatory Framework

Air quality and pollutant emissions to the air are regulated under both

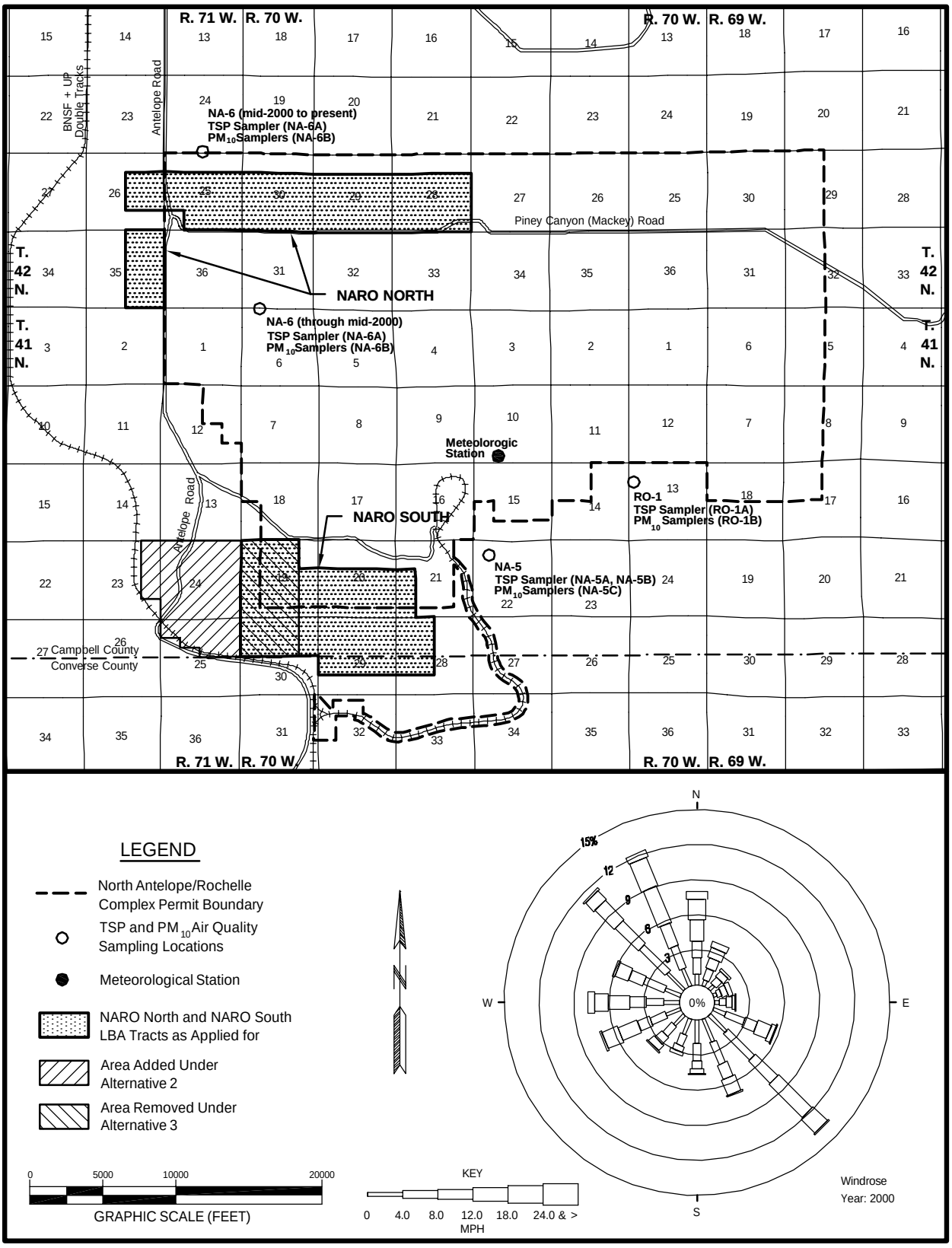

Figure 3-3. Wind Rose, Air Quality and Meteorological Stations at the North Antelope/Rochelle Complex.

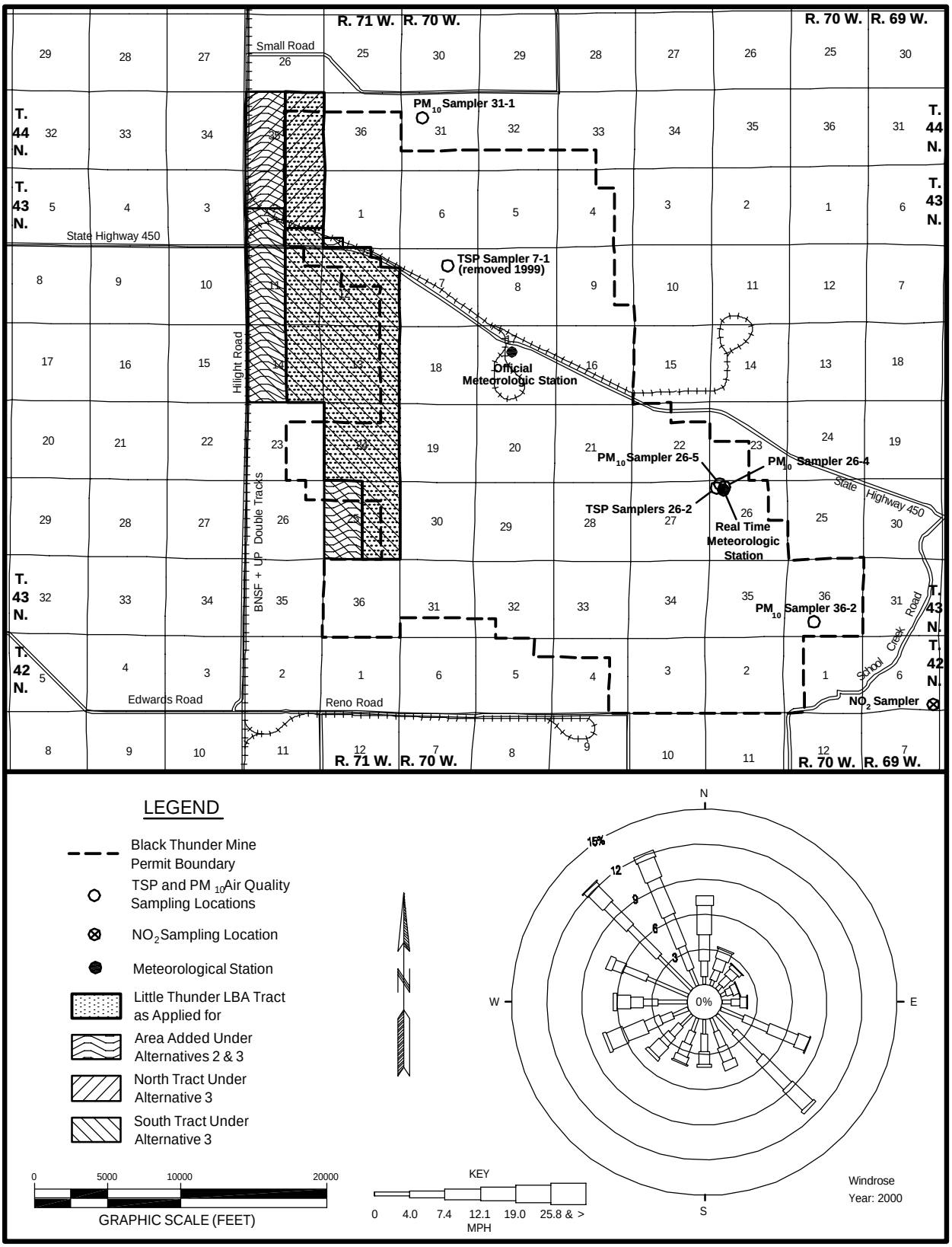

Figure 3-4. Wind Rose, Air Quality and Meteorological Stations at the Black Thunder Mine.

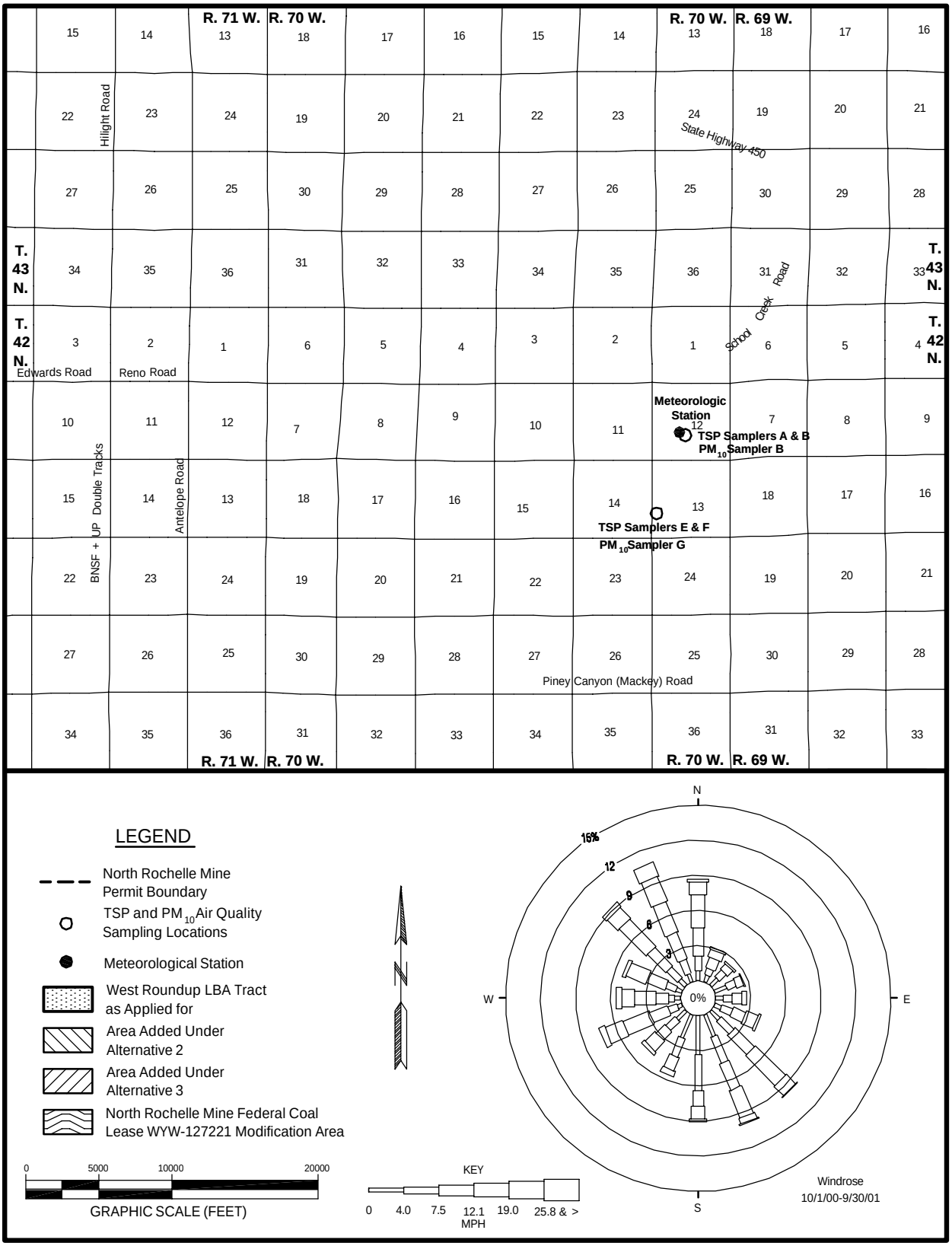

Figure 3-5. Wind Rose, Air Quality and Meteorological Stations at the North Rochelle Mine.

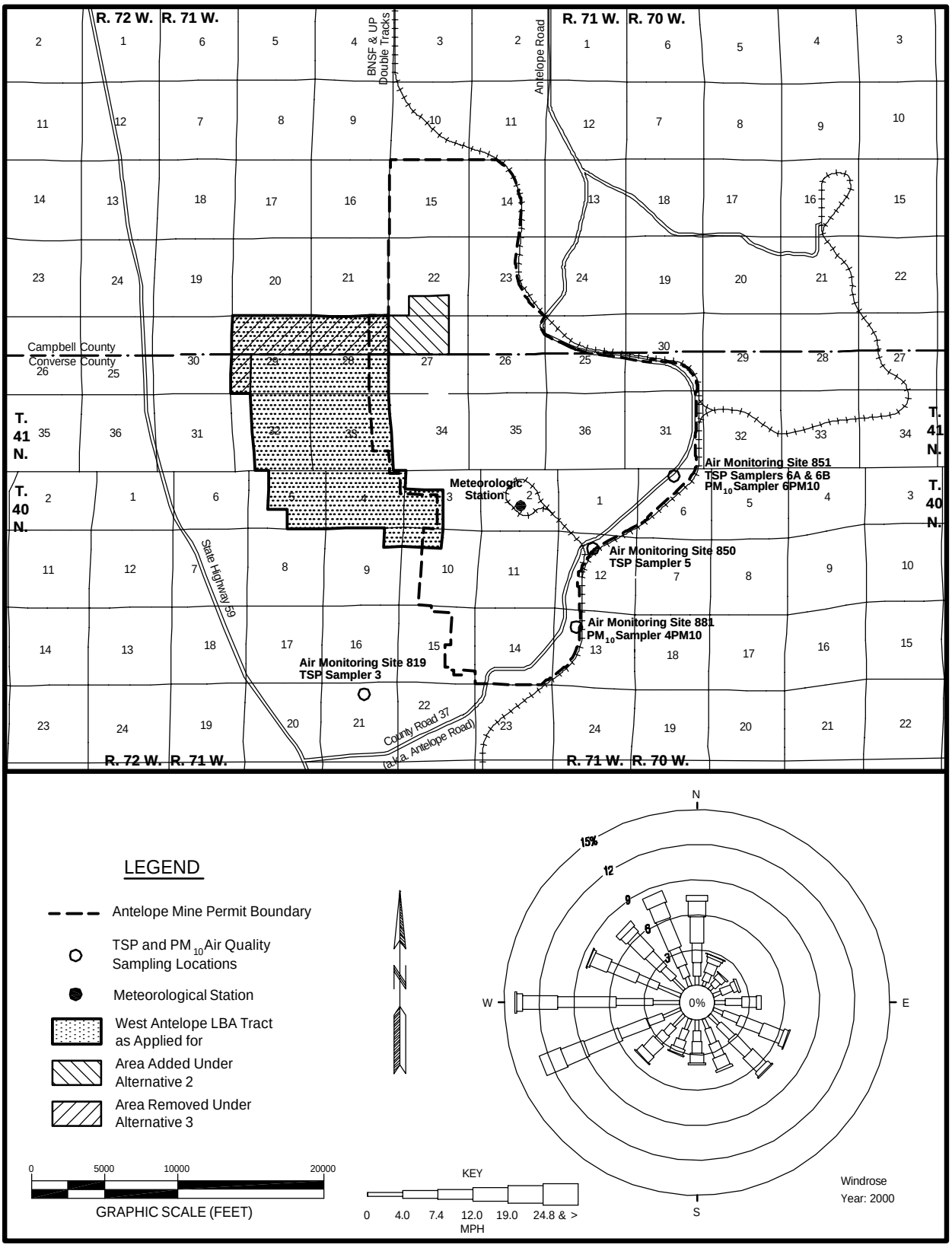

Figure 3-6. Wind Rose, Air Quality and Meteorological Stations at the Antelope Mine.

federal laws and regulations (CAA) and WAQSR administered by the WDEQ/AQD. A fundamental requirement of both federal and state regulations is that ambient concentrations for specific criteria pollutants not exceed allowable levels, referred to as the Ambient Air Quality Standards (AAQS). These standards have been established by the U.S. EPA and the WDEQ at levels deemed necessary to preclude adverse impacts on human health and welfare. The National AAQS (or NAAQS) set nationwide thresholds for maximum acceptable concentrations of various pollutants. The Wyoming AAQS (or WAAQS) must be at least as stringent as NAAQS. Selected Wyoming and national ambient air standards are shown in Table 3-1. The NAAQS and WAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access.

The assumed background pollutant concentrations included in Table 3-1 were derived by Argonne National Laboratory based on a review of available monitoring data measured throughout northeastern Wyoming and southeastern Montana. The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

Pursuant to the CAA, the EPA has developed classifications for distinct geographic regions known as air basins and for major MSAs. Under these classifications, for each federal criteria pollutant, each air basin (or portion of a basin or MSA) is classified as in "attainment" if the area has "attained" compliance with (that is, not exceeded) the adopted NAAQS for that pollutant, or is classified as "non-attainment" if the levels of ambient air pollution exceed the NAAQS for that pollutant. Areas for which sufficient ambient monitoring data are not available are designated as "unclassified" for those particular pollutants. States designate areas within their borders as being in "attainment" or "non-attainment" with the AAQS. Existing air quality throughout most of the PRB in Wyoming is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table 3-1. However, the Sheridan, Wyoming area has been designated as a non-attainment area (PM_{10} – moderate) where the applicable standards have been violated in the past.

Future development projects that have the potential to emit more than 250 tpy of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tpy) would be required to undergo a regulatory PSD Increment Consumption analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of BACT and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, or SO_2. The PSD increments are shown in Table 3-1.

Table 3-1. Assumed Background Air Pollutant Concentrations, Applicable Ambient Table Air Quality Standards, and PSD Increment Values (in σg/m^3).

Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	Wyoming Standards	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,500[3]	40,000	40,000	40,000	---	---
	8-hour	1,500	10,000	10,000	10,000	---	---
Nitrogen dioxide	Annual	16.5[4]	100	100	100	2.5	25
Ozone	1-hour	82[5]	235	235	235	---	---
	8-hour	130[5]	157	157	157	---	---
Sulfur dioxide	3-hour	8[6]	---	1,300	1,300	25	512
	24-hour	8[6]	365	---	260	5	91
	Annual	3[6]	80	---	60	2	20
PM_{10}	24-hour	42[7]	150	150	150	8	30
	Annual	17[7]	50	50	50	4	17
$PM_{2.5}$	24-hour	19[7]	65	65	65	---	---
	Annual	7.6[7]	15	15	15	---	---

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
3 Amoco Ryckman Creek collected for an eight month period during 1978-1979, summarized in the Riley Ridge (BLM 1983).
4 Data collected in Gillette, Wyoming (1996 - 1997).
5 Data collected in Pinedale, Wyoming (1992 - 1994).
6 Data collected in Devil's Tower, Wyoming (1983).
7 Data collected in Gillette, Wyoming (1999).
Source: (Argonne 2002)

Existing surface coal mining operations in the PRB, including the General Analysis Area, are not subject to PSD regulations for two reasons. Surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation and point-source emissions from individual mines do not exceed the PSD emissions threshold. A new mine would be classified as a major source and subject to PSD review if potential emissions of any regulated pollutant equal or exceed 250 tpy. Fugitive emissions are not included in the definition of potential emissions except for certain specified source types [40 CFR 52.21, (b)(1)(iii)]. Mining related fugitive emissions are exempt from the applicability determination.

The WDEQ/AQD administers a permitting program to assist the agency in managing the State's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In addition to the designations relative to attainment of the NAAQS, the CAA requires the EPA to place each airshed within the U.S. into one of three PSD area classifications. PSD Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in National Parks and Wilderness Areas of a given size which were in existence prior to 1977 or those additional areas which have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II areas, which allow a relatively greater deterioration of air quality over that in existence in 1977, although still within the NAAQS. No Class III areas, which would allow air quality to degrade to the NAAQS, have been designated. The federal land managers have also identified certain federal assets with Class II status as “sensitive” Class II areas for which air quality and/or visibility are valued resources. The federal CAA also provides specific visibility protection of mandatory federal Class I areas. Mandatory Federal Class I areas were designated by the U.S. Congress on August 7, 1977, and include wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. Table 3-2 is a list of mandatory federal Class I areas, tribal Class I areas, and federal Class II areas in the region and their distance from the General Analysis Area. Wind Cave National Park, Badlands Wilderness Area, and the Northern Cheyenne Indian Reservation are the closest mandatory federal Class I areas. Table 3-2 also lists other areas which are more distant but were included in the cumulative air quality impact analysis discussed in Section 4.5.4. As shown in Table 3-1, the allowable incremental impacts for NO_2, PM_{10}, and SO_2 within PSD Class I areas are very limited. Most of the PRB in Wyoming is designated as PSD Class II with less stringent requirements. Even though the development

Table 3-2. Approximate Distances and Directions from the General Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance	Direction to
Mandatory Area		
Badlands Wilderness Area[1]	130	E
Bridger Wilderness Area	215	W
Fitzpatrick Wilderness Area	220	W
Gates of the Mountain Wilderness Area	235	WNW
Grand Teton National Park	275	W
North Absaroka Wilderness Area	225	WNW
Red Rocks Lake Wilderness Area	355	WNW
Scapegoat Wilderness Area	445	NW
Teton Wilderness Area	230	W
Theodore Roosevelt National Park (North Unit)	290	NNE
Theodore Roosevelt National Park (South Unit)	245	NNE
U.L. Bend Wilderness Area	305	NNW
Washakie Wilderness Area	195	W
Wind Cave National Park	95	E
Yellowstone National Park	255	WNW
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	330	N
Northern Cheyenne Indian Reservation	125	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	245	WNW
Agate Fossil Beds National Monument	110	ESE
Bighorn Canyon National Recreation Area	155	NW
Black Elk Wilderness Area	80	ENE
Cloud Peak Wilderness Area	85	WNW
Crow Indian Reservation	115	NW
Devils Towner National Monument	65	NNE
Fort Belknap Indian Reservation	350	NNW
Fort Laramie National Historic Site	90	SSE
Jewel Cave National Monument	70	E
Mount Rushmore National Memorial	90	ENE
Popo Agie Wilderness Area	205	WSW
Soldier Creek Wilderness Area	130	ESE

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

activities being considered in this EIS would occur within areas designated PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any distant PSD Class I area.

3.5.4 Existing Air Quality

WDEQ/AQD detects changes in air quality through monitoring and maintains an extensive network of air quality monitors throughout the state. Particulate matter is most commonly measured as particles finer than 10 microns or PM_{10}. The eastern side of the PRB has one of the most extensive networks of monitors for PM_{10} in the nation due to the density of coal mines (Figure 3-7). In addition, there are also monitors in Sheridan and Gillette, and the WDEQ/AQD installed monitors at Arvada and Wright, Wyoming in November 2002.

WDEQ/AQD uses monitoring stations located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality and not located to measure impacts from a specific source. Monitors located to measure impacts from a specific source may also be used for trends. These data are used to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings in the PRB were increasing due to increased CBM activity and exacerbated by prolonged drought, the WDEQ approached the counties, coal mines, and CBM industry. A coalition involving the counties, coal companies, and CBM operators have made significant efforts towards minimizing dust from roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads.

Monitoring is also used to measure compliance. Where monitoring shows a violation of any standard, the WDEQ can take a range of enforcement actions to remedy the situation. Where a standard is exceeded specific to an operation, the enforcement action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

WDEQ has also sited two visibility monitoring stations in the PRB. One of these sites is 32 miles north of Gillette and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure Ozone and instruments to measure Oxides of Nitrogen (NO, NO_2, NO_x). The other visibility monitoring station is located 14 miles west of Buffalo and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), and a digital camera.

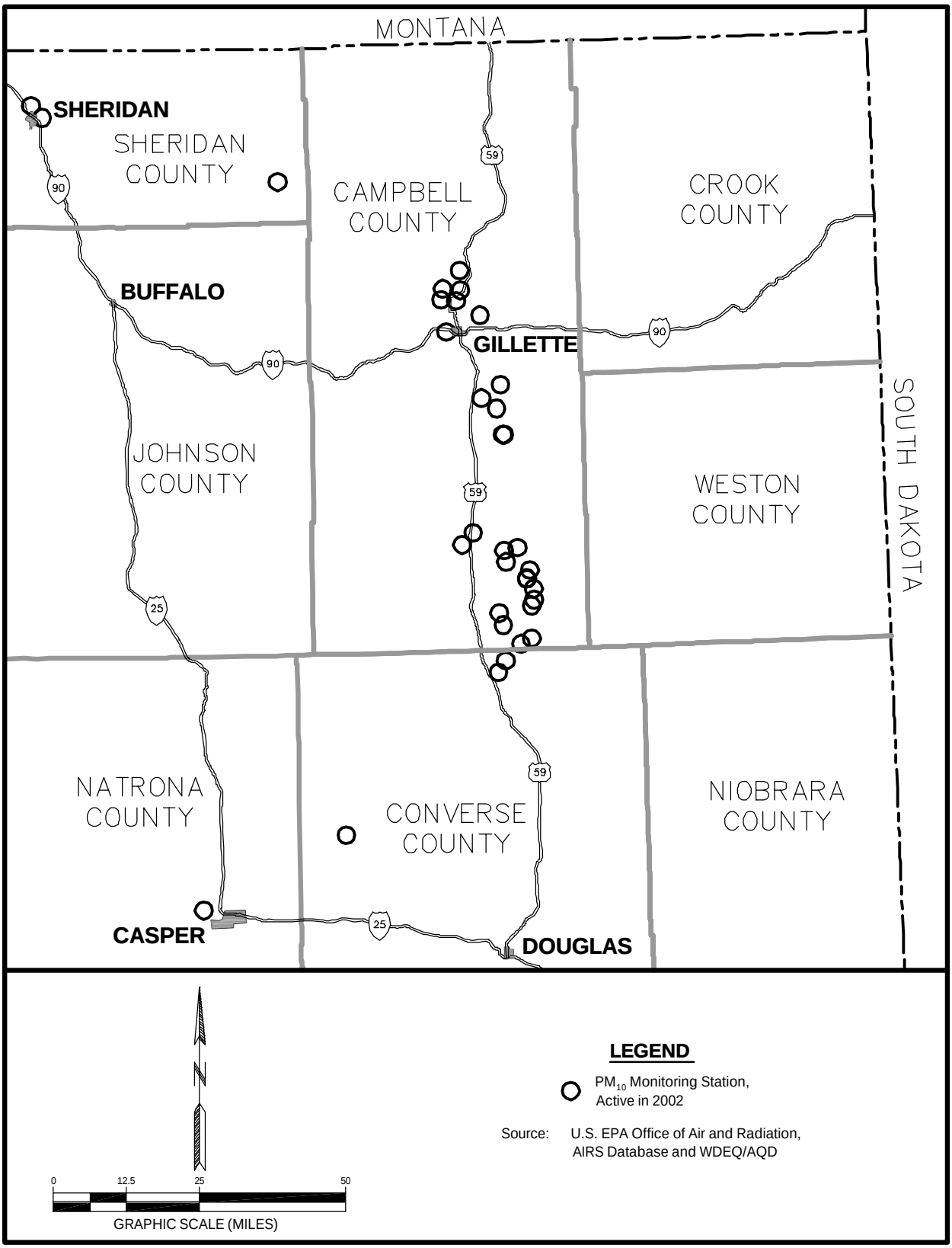

Figure 3-7. Active PM_{10} Monitoring Stations in Northeastern Wyoming.

Other air quality monitoring programs that are in place in the PRB include WDEQ NO_2 monitoring along the east side of the Basin, WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and NADP monitoring of precipitation chemistry in Newcastle.

Air quality conditions in rural areas are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of CO and particulate matter may occur in more urbanized areas (for example, Buffalo, Gillette, and Sheridan) and around industrial facilities, especially under stable atmospheric conditions common during winter.

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading and hauling of overburden and coal, and the large areas of disturbed land all produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM_{10}) is the major significant pollutant from coal mine point sources.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous, orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, as discussed in Section 4.1.4. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming=s ambient air standards for NO_2 are shown in Table 3-1.

Other existing air pollutant emission sources within the region include:

- exhaust emissions (primarily CO and NO_x) from existing natural gas fired compressor engines used in production of natural gas and CBM; gasoline and diesel vehicle tailpipe emissions of combustion pollutants (VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2);
- dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, and road sanding during the winter months;
- transport of air pollutants from emission sources located outside the region;
- emissions from railroad locomotives used to haul coal (primarily NO_2 and PM_{10}); and
- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 45 miles southwest of the General Analysis Area, and the Wyodak, Wygen, and Neil Simpson

plants, located about 35 miles north of the General Analysis Area.

3.5.5 Historical Ambient Air Quality: Particulates

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1989, the federally regulated particulate matter pollutant was changed from a TSP based standard to a PM_{10} based standard. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM_{10} based standards to match the federal standards in 1989 and retained the TSP standards as state standards until March 2000. Wyoming's ambient air standards for PM_{10} are shown in Table 3-1. Wyoming adopted a $PM_{2.5}$ standard in March 2000. However, the State of Wyoming will not enforce the above standard until EPA has completed its review of the $PM_{2.5}$ standard and has determined to retain and enforce the standard as promulgated on July 18, 1997.

3.5.5.1 Regional

WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the SPRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM_{10} monitors are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days beginning in 2002. Data for TSP dates back to 1980 with data for PM_{10} dating back to 1989. This has resulted in over 55,000 TSP and 14,000 PM_{10} samples had been collected through 2002, which makes the eastern PRB one of the most densely monitored areas in the world (Figure 3-7). Table 3-3 uses the annual arithmetic average of all sites to summarize these data from 1980 through 2002.

As indicated in Table 3-3, the long-term trend in particulate emissions remained relatively flat through 1998. TSP concentration from 1980 through 1998 averaged 33.1 $\mu g/m^3$, ranging between 27.8 $\mu g/m^3$ and 39.4 $\mu g/m^3$. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. PM_{10} concentration from 1989 through 1998 averaged 15.4 $\mu g/m^3$, ranging between 12.9 $\mu g/m^3$ and 16.5 $\mu g/m^3$.

This time period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 308 mmtpy (an increase of over 249 mmtpy), and associated overburden production increased from 105 mmbcy to over 710 mmbcy per year (a 605 mmbcy per year increase). From 1990 through 2002 the average annual increase in coal production was 7.0 percent, while annual overburden production increased an average of 13.9 percent over the same time

Table 3-3. Summary of WDEQ/AQD Reports on Air Quality Monitoring in Wyoming's PRB, 1980-2002.

Year	Coal Produced (mmtpy)	Yards Moved (mmbcy)	Number of Mines Operating/ Monitoring TSP/ Monitoring PM_{10}[1]	Number of TSP/PM_{10} Monitoring Sites[2]	TSP Average ($\mu g/m^3$)	PM_{10} Average ($\mu g/m^3$)
1980	58.7	105.3	10/14/0	34/0	35.5	na[3]
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4
2001	354.1	927.1	12/11/12	29/29	57.5	27.2
2002	359.7	1,032.1	13/11/13	23/38	56.0	23.3

[1] Mines include Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, North Antelope, Rochelle, and Antelope.

[2] Some sites include more than one sampler, so the number of samplers is greater than the number of sites.

[3] Not applicable because no monitoring for PM_{10} was done.

Sources: 1980 through 1996 emissions and production data from April 1997 report prepared by WMA for WDEQ/AQD. 1997 through 2002 emissions data from EPA AIRData database. 1997 through 2002 emissions and production data from WDEQ/AQD.

period. The larger annual increase in overburden production is probably due to the fact that the mines are gradually moving into deeper coals as the shallower reserves are mined out.

The relatively flat trend in particulate emissions from 1980 through 1998 is due in large part to the Wyoming Air Quality Program that requires BACT at all permitted facilities. BACT control measures include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetation of disturbed areas to reduce wind erosion, and timely final reclamation.

The average annual TSP concentration increased from 33.9 $\mu g/m^3$ in 1998 to 55.3 $\mu g/m^3$ in 1999 and 57.5 $\mu g/m^3$ in 2001. The 2002 average annual TSP concentration was 56.0 $\mu g/m^3$. The average annual PM_{10} concentration increased from 15.9 $\mu g/m^3$ in 1998 to 21.6 $\mu g/m^3$ in 1999 and 27.2 $\mu g/m^3$ through 2001. In 2002, the average annual concentration was at 23.3 $\mu g/m^3$. There have been no major fires in the region during this time. The increases in coal production over those four years (3.8 percent per year and 12.8 mmtpy over the four-year period) and associated overburden production (9.8 percent per year and 72 mmbcy over the four-year period) were not larger than the four-year increases during some of the previous 18 years, but the particulate concentration increase was much larger than in previous years. The potential causes of and development of effective measures to limit the increasing particulate levels that have been documented through monitoring in this area since the mid-1990s are of concern to air quality regulators and to oil and gas and coal operators in this area.

3.5.5.2 Site Specific

Within the General Analysis Area, historical particulate matter ambient air quality data generally show the same results as described above for the PRB as a whole. Each of the four mines included in this analysis has a meteorological station and a number of particulate emission monitoring samplers (Figures 3-3 through 3-6). Progression of mining operations require that the location and number of particulate monitors be adjusted accordingly in order to best document the ambient air quality at each respective mine. Figure 3-8 presents the average annual TSP and PM_{10} measured at these samplers within the General Analysis Area from 1995 through 2002. In 2000, there were 13 TSP monitoring samplers at these four mines and in 2002, three of the four mines were still monitoring TSP at seven samplers. In 2000, there were 11 PM_{10} monitoring samplers and in 2002, there were 12 PM_{10} samplers at these four SPRB mines.

Cumulative coal and overburden production for the four SPRB mines included in this analysis for these years are also shown on Figure 3-8. As discussed above, coal and overburden production for the SPRB mines have steadily increased since 1980.

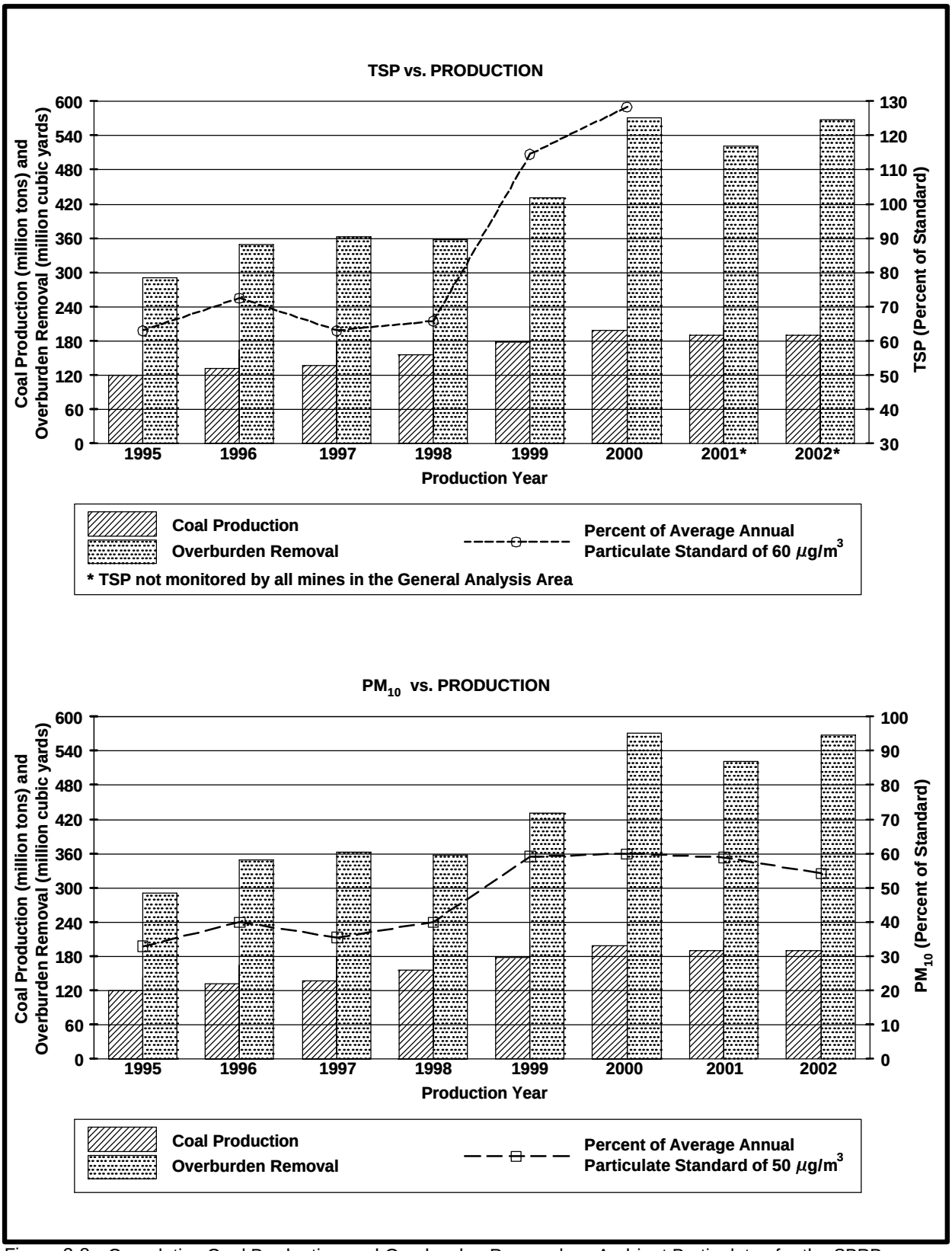

Figure 3-8. Cumulative Coal Production and Overburden Removal vs. Ambient Particulates for the SPRB General Analysis Area (1995 through 2002).

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM_{10} became a federal standard in 1989 and was also adopted by the State of Wyoming. There were no violations of the TSP standard at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, or Antelope Mines when TSP was the federally regulated pollutant. After 1989, and until recently, TSP measurements were used as a surrogate for PM_{10} in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM_{10} sampler.

There were no violations of the PM_{10} standards anywhere in the PRB prior to April 2001. Between April 2001 and June 2003, there were 21 monitored exceedances of the 24-hour PM_{10} standard at four mines in the Wyoming PRB. Two of the applicant mines for LBA tracts being considered for leasing in this EIS (North Rochelle and Black Thunder) were responsible for 19 of the 21 violations.

3.5.5.3 Control Measures

Control of particulate emissions at the SPRB mines is accomplished with a variety of measures. Emissions at coal crushing, storage, and handling facilities (point sources) are controlled with baghouse dust collection systems, PECs, or atomizers/foggers. These are all considered BACT controls by WDEQ/AQD.

Fugitive emissions are also controlled with a variety of measures that the agency considers BACT. Typically, mine access roads have been paved and water trucks are used to apply water and chemical dust suppressants on all haul roads used by trucks and/or scrapers. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely permanent and temporary revegetation of disturbed areas is utilized to minimize wind erosion. Fugitive emissions from the coal truck dumps are controlled with stilling sheds.

WDEQ/AQD has increased monitoring frequency requirements and required installation of continuous monitors at all PRB coal mines. The North Rochelle Mine, Black Thunder Mine, and Jacobs Ranch Mine have installed continuous PM_{10} samplers at six air quality sample sites which are connected to the companies' computer network so that anyone on the system can see the latest sampler loadings. Mine personnel monitor the information and are instructed to notify engineering and/or operations staff when particulate concentrations rise above a trigger level, so that operations can be undertaken to reduce the concentrations. PRCC has installed three continuous PM_{10} monitors at North Antelope/Rochelle Complex.

The WDEQ/AQD is continually reviewing the data and considering

regulatory options, which may include enforcement actions such as Notices of Violation resulting in a consent decree and/or modified permit conditions. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBM development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the SIP.

The coal mines in this area are actively participating in a dust control coalition formed to help address dust from more than 20 miles of regional county roads. The coalition includes the Campbell County Commission and several regional CBM and oil producing companies as well as the coal mine operators. The coalition has utilized chemical treatments to control dust as well as closing roads where appropriate or necessary and rebuilding existing roads to higher specifications. In 2003, PRCC, with the approval of the USDA-FS and Campbell County, is scheduled to implement a plan to close approximately 5.3 miles of Piney Canyon Road and upgrade approximately 2.5 miles of the Payne Road by surfacing it with a permanent treatment proven to reduce dust emissions.

Some of the mines have participated in this effort to control fugitive emissions from unpaved county roads.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, watering of inactive areas and problem areas; relocation of overburden truck-dumping operations; deferring blasting; curtailing topsoil stripping, reclamation dozer operations, and/or production operations; requiring windrows in areas stripped of topsoil; requiring treatment of windrow areas with chemical dust suppressants; inter-seeding of topsoil stockpiles; and soil stabilization. The mines are experimenting with dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (e.g., meteorological conditions, control steps implemented) for monitored exceedances, and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

3.5.6 Historical Ambient Air Quality: NO_2

3.5.6.1 Regional

NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. One of these locations is in the General Analysis Area. Table 3-4 summarizes the results of that monitoring. Beginning in 2001, the coal industry in cooperation with WDEQ/AQD installed a network of NO_2 monitors in the PRB. The 2001 and 2002 data

Table 3-4. Annual Ambient NO_2 Concentration Data.

Site	Gillette, WY	Black Thunder Mine	Belle Ayr Mine	Bill, WY
Year	Percent of Standard[1]	Percent of Standard[1]	Percent of Standard[1]	Percent of Standard[1]
1975	6*			
1976	4*			1*
1977	4*			5*
1978	11*			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996[3]	16	16	22	22

[1] Based on arithmetic averaging of data.
[2] Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
[3] Arithmetic average – actual sampling ran from March 1996 to April 1997.
* Inadequate number of samples for a valid annual average.
Source: (McVehil-Monnett 1997)

from this regional network are summarized in Table 3-5.

Annual NO_2 levels measured in the March 1996 to April 1997 timeframe were below applicable standards. The highest reading was 22 µg/m^3 as compared to the 100 µg/m^3 standard. All 2001 annual mean NO_2 concentrations are well below the 100 µg/m^3 standard.

3.5.6.2 Site Specific

As discussed above, NO_2 monitoring results are available from several sites in the General Analysis Area. The Gillette monitoring site is located approximately 38 miles north, the Belle Ayr Mine site is located approximately 23.5 miles north, the Black Thunder Mine site is located within the General Analysis Area, and the Bill site is located approximately 18 miles south.

Control Measures

All four mines included in this analysis have implemented programs designed to control/limit public exposure to the intermittent, short-term NO_2 releases associated with blasting and they all comply with the blasting plan publication/notification requirements associated with the Permits to Mine issued by WDEQ/LQD.

Table 3-5. 2001 and 2002 Annual Mean NO_2 Concentration Data.

Monitor	2001 Mean NO_2 Concentration ($\sigma g/m^3$)[1, 2]	2002 Mean NO_2 Concentration ($\sigma g/m^3$)[3, 4]
Antelope Mine	7	6
Belle Ayr Mine	14	14
Black Thunder Mine	5*	6
TBNG	6**	5

* Data for the third quarter is questionable and therefore is not used in the determination of the annual mean for the site.

** Data for May through December 2001. Monitor was not operational until May 2, 2001.

1 Mine Data (WDEQ/AQD 2002)

2 TBNG Site (ARS 2002)

3 Mine Data (WDEQ/AQD 2003a)

4 TBNG Site (ARS 2003)

There have been no reported events of public exposure to NO_2 from blasting activities at the North Antelope/Rochelle Complex, the North Rochelle Mine, or the Antelope Mine. These mines have instituted voluntary measures to be implemented when large blasts are planned. These voluntary measures include:

- phone notification of neighbors and workers in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible; and
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area.

Black Thunder Mine received several reports of public exposure to NO_2 from blasting prior to 2001. Measures to prevent future such incidences have been instituted at the Black Thunder Mine when large overburden blasts are planned. These measures, which are a permit requirement, include:

- notification of neighbors and workers in the general area of the mine prior to the blast;
- blast detonation between 12:00 p.m. and 3:00 p.m. whenever possible to avoid temperature inversions and minimize inconvenience to neighbors;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a blast;
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area; and

- closing public roads when appropriate to protect the public.

Mine operators in the eastern PRB, including the General Analysis Area, have also been working with blasting agent manufacturers to reduce NO_x emissions through changing the size of the blasts and the use of different blasting agents, mixtures, and additives. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, using electronic detonation systems that can vary shot timing, different shot hole patterns, and using plastic liners within the shot holes. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots. (Doug Emme 2003; Rick Chancellor 2003). All of the mines in the General Analysis Area have also participated in the installation and operation of the regional NO_2 monitoring network discussed earlier.

3.5.7 Air Quality Related Values - Visibility and Acidification of Lakes

AQRVs, including the potential air pollutant effects on visibility and the acidification of lakes and streams, are applied to PSD Class I and sensitive Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards.

3.5.7.1 Visibility

Potential impacts to visibility were considered at 29 PSD Class I and sensitive Class II areas in the vicinity of the General Analysis Area. Table 3-2 shows the nearest distances from the sensitive receptor areas to the General Analysis Area.

Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Presently, the visibility conditions monitored in the Bridger Wilderness Area are among the best in the U.S.

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA=s Regional Haze Rule to achieve the National Visibility Goal. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment. Figure 3-9 shows annual averages for the 20 percent best, worst, and average visibility days at Badlands and Bridger Wilderness Areas from 1989 to 2001 (IMPROVE 2002).

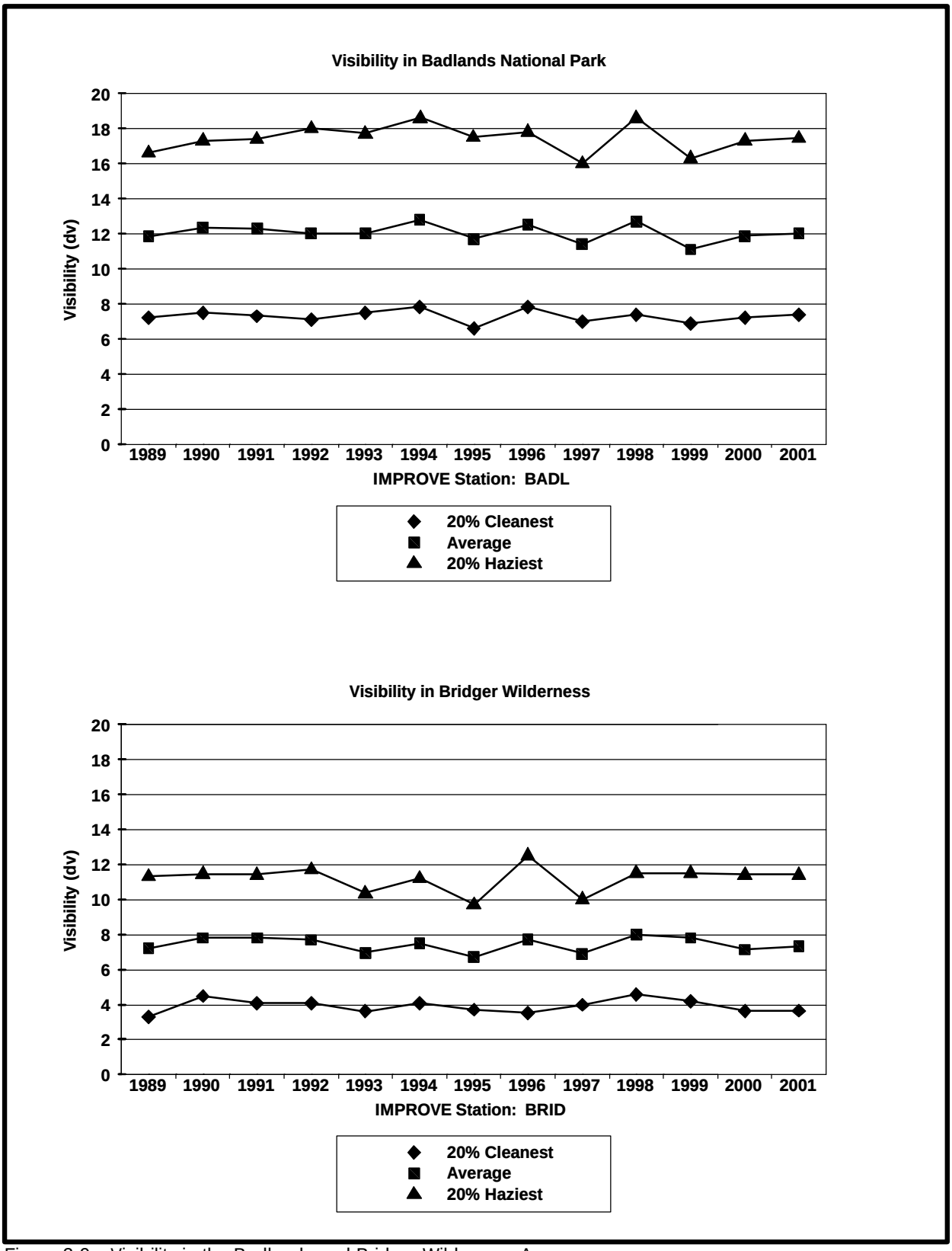

Figure 3-9. Visibility in the Badlands and Bridger Wilderness Areas.

3.5.7.2 Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). Lake acidification is expressed as the change in ANC measured in microequivalents per liter (µeq/L), the lake's capacity to resist acidification from acid rain. Table 3-6 shows the existing ANC monitored in some mountain lakes and their distance from the General Analysis Area.

3.6 Water Resources

3.6.1 Groundwater

The General Analysis Area contains three water-bearing geologic units that could be disturbed by mining. In descending order, these units are the recent alluvium, Wasatch Formation overburden, and the Wyodak coal seam or its local equivalent. The underlying, sub-coal Fort Union Formation and the Fox Hills Sandstone of the Lance Formation are utilized for water supply by coal mines within the General Analysis Area, but these units are not physically disturbed by mining activities. Site-specific data have been collected by PRCC, TBCC, TCC, and ACC to characterize baseline hydrologic conditions in each of the respective LBA tracts. Figure 3-2 presents the hydrostratigraphic units underlying the General Analysis Area. The four mines included in this analysis have a total of 64 monitoring wells within or near the five LBA tracts. These include 10 monitoring wells in the alluvium, 12 monitoring wells in the Wasatch Formation overburden, 32 monitoring wells in the coal, and 10 monitoring wells in the underburden.

Recent Alluvium

With the exception of Porcupine Creek (NARO North LBA Tract) and Antelope Creek (West Antelope LBA Tract), which both contain alluvial aquifers composed of coarse-grained sand and fine gravels, the drainages in the LBA tracts are generally dry draws. The alluvial and colluvial deposits associated with these draws are generally thin and not laterally extensive enough to be considered an aquifer.

Wasatch Formation

Within the PRB the Wasatch Formation consists of interbedded sandstones, siltstones, and shale with occasional discontinuous coal stringers and clinker deposits. This description basically holds true for all of the LBA tracts and their alternatives contained within the General Analysis Area. Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones. The hydraulic connection between sandstone lenses is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells, and this water is primarily used for stock watering. Because the saturated sandstone and coal units within the Wasatch Formation are not

Table 3-6. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	10 percent most Sensitive ANC (µeq/L)	Distance from General Analysis Area (miles)
Bridger	Black Joe	69.0	220
	Deep	61.0	210
	Hobbs	68.0	225
	Upper Frozen	5.8[1]	230
Cloud Peak	Emerald	55.3	120
	Florence	32.7	105
Fitzpatrick	Ross	61.4	220
Popo Agie	Lower Saddlebag	55.5	210

[1] The background ANC is based on only six samples taken between 1997 and 2001.
Source: Argonne (2002)

continuous, the Wasatch is not considered to be a regional aquifer.

Another geologic unit which may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments which were baked, fused, and melted in place when the underlying coal burned spontaneously. These burned sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site specific; the NARO South LBA Tract is the only tract in the General Analysis Area containing any appreciable amount of scoria. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous overburden and Wyodak coal.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, and by seepage into the alluvium along stream drainages. For the Wasatch Formation as a whole, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well.

Water quality in the Wasatch Formation is extremely variable, with TDS concentrations ranging from 360 mg/L to 7,360 mg/L in the General Analysis Area.

Wyodak Coal

Within the General Analysis Area the Wyodak coal seam is most often divided by partings that separate it into two or more units. The separate units are typically given local names which vary from mine to mine. (e.g., Upper and Lower Wyodak). A general discussion of the coal seam aquifer is presented as follows.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer within the PRB. Hydraulic conductivity within the Wyodak coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, are created by the expansion of the coal as the weight of overlying sediments is slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the south Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as “lineaments”. Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only.

The chemistry of groundwater in the coal is variable within the General Analysis Area. In general, it is a sodium-bicarbonate type with TDS concentrations increasing in a downdip direction. Within the General Analysis Area, TDS concentrations of groundwater in the coal range from 382 mg/L to 4,840 mg/L.

Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas near the outcrop and burn zone into the basin, following the dip of the coal. Site-specific water-level data collected from monitoring wells by mining companies and presented in the GAGMO 20-year report (Hydro-Engineering 2001) and GAGMO reports published in previous years indicate that the groundwater flow directions have been influenced by mining activities. Near active mining areas, groundwater flow within the coal aquifer is typically toward the mine pits.

Subcoal Fort Union Formation

The subcoal Fort Union Formation can be divided into three hydrologic units: the Tongue River aquifer, the Lebo Member, and the Tullock aquifer (Law 1976). The hydrologic units below the Wyodak coal are not directly disturbed by mining, but many mines use them for water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits,

dewatering, and CBM development (BLM 2001b). The Tongue River aquifer consists of lenticular fine-grained shale and sandstone. The Lebo Member, also referred to as "the Lebo confining layer", is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivity is equal to an aquifer's hydraulic conductivity or permeability times its thickness and is commonly used when discussing the hydraulic properties of the subcoal Fort Union Formation, where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer than in the Tongue River or Lebo, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported by OSM (1984) is 290 ft^2/day. All five of the mines located within the General Analysis Area use deep wells completed in the subcoal Fort Union Formation for water supply. Fort Union water supply wells in the General Analysis Area generally range from 600 to 2,000 ft in depth.

The water quality of the subcoal Fort Union Formation is generally good. TDS concentrations measured in various subcoal Fort Union Formation water supply wells in the General Analysis Area range from 230 mg/L to 520 mg/L. Water from the subcoal Fort Union Formation is of the sodium- bicarbonate type. This water is generally suitable for domestic use and may be suitable for livestock and wildlife watering, as well as irrigation, depending upon TDS concentrations and site-specific SAR values.

Lance and Fox Hills Formations

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. At the base of the Lance Formation is the Fox Hills Sandstone. The Lance Formation and Fox Hills Sandstone are used for water supply by PRCC at the North Antelope/Rochelle Complex. The North Antelope/Rochelle Complex water supply well is 5,400 ft deep and capable of producing about 400 gpm. Water from this well is of the sodium-bicarbonate type with a TDS concentration of approximately 1,200 mg/L. This water is suitable for livestock and wildlife watering.

3.6.2 Surface Water

From north to south, the General Analysis Area is drained by North Prong Little Thunder Creek, Little Thunder Creek, Porcupine Creek, Spring Creek, and Antelope Creek (Figure 3-10). North Prong Little Thunder Creek is a tributary of Little Thunder Creek, which is a tributary of Black Thunder Creek. Porcupine Creek and Spring Creek are tributaries of Antelope Creek. Both Black Thunder Creek and Antelope Creek are tributaries of the Cheyenne River.

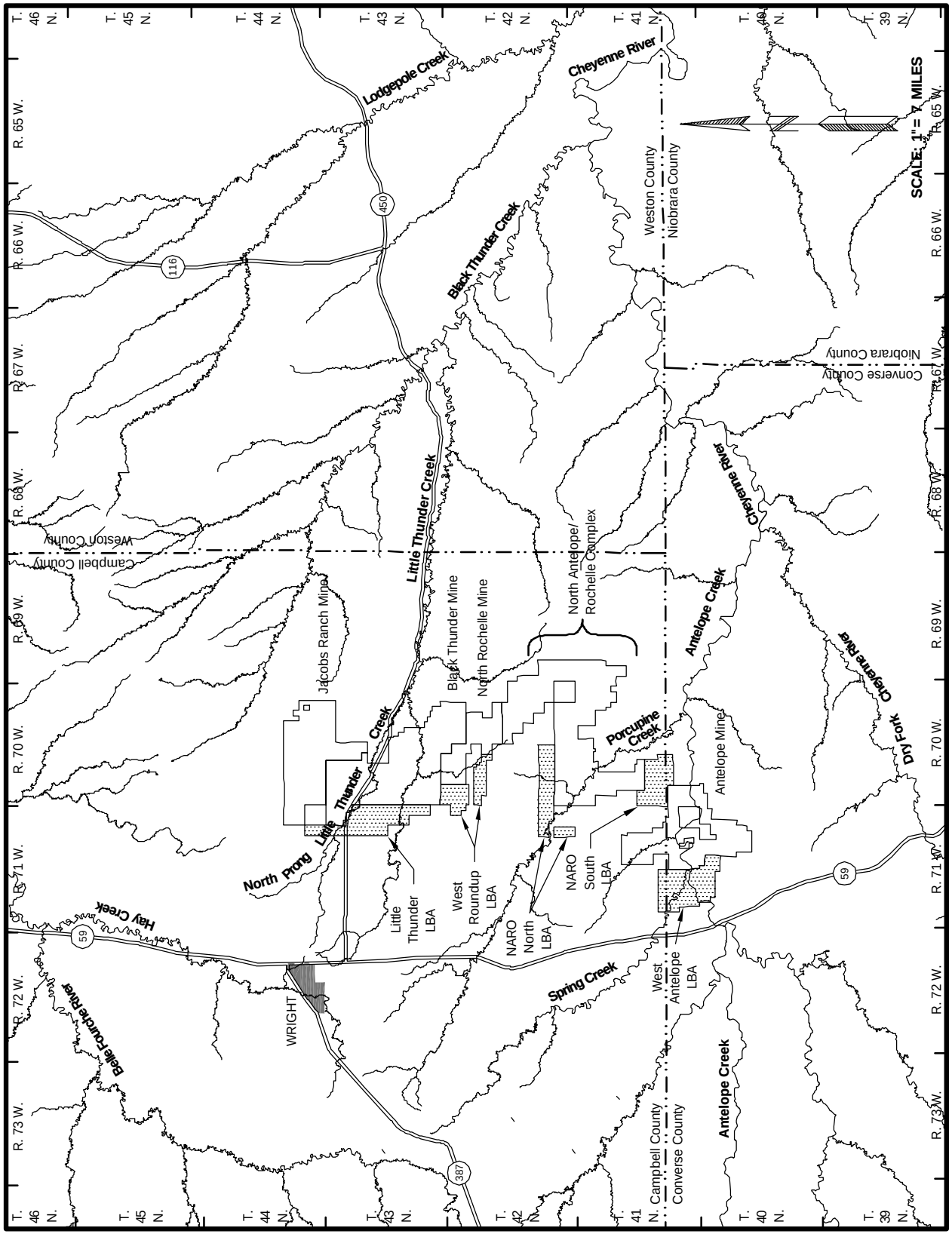

Figure 3-10. Surface Drainage in the General Analysis Area.

The Little Thunder and West Roundup LBA Tracts are located in the headwater area of Little Thunder Creek. Surface water flow in the streams within these two tracts (Little Thunder Creek, North Prong Little Thunder Creek, Dry Fork Little Thunder Creek, Trussler Creek, and Olson Draw) has historically been ephemeral (i.e., they flow only in direct response to rainfall or snowmelt).

Porcupine Creek and its tributaries, Boss Draw and Corder Creek, drain the NARO North LBA Tract. Porcupine Creek is a meandering, ephemeral to intermittent stream.

The NARO South and West Antelope LBA Tracts are in the Antelope Creek watershed. Streams in this area include Antelope Creek, Spring Creek, and several unnamed tributaries to Antelope Creek. Antelope Creek is an intermittent stream that, prior to mining, received a small degree of baseflow from coal seams.

Water quality in each of these streams is highly dependent on flow. Typically, high flows are low in TDS and low flows are higher in TDS. The ephemeral nature of the majority of these streams results in a paucity of surface water quality data. Antelope Creek does, however, have regular flow, and as a result, ACC has extensive flow and quality records.

3.6.3 Water Rights

Water rights in Wyoming are administered by Wyoming SEO. Water rights are granted for both groundwater and surface water appropriations. Prior to development of water resources associated with energy development, water appropriations (either groundwater or surface water) in the southern PRB were typically for livestock use. Currently, the majority of the water rights in the General Analysis Area are held by mining companies and methane development companies.

Records of the SEO have been searched for groundwater rights within a three-mile radius of each LBA tract as applied for under the Proposed Action and Action Alternatives. This information is required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A listing of the non-coal mine related groundwater rights within a three-mile radius of each tract is presented in Appendix F.

For the NARO North LBA Tract, SEO data indicate that, as of July 2003, there are 452 permitted water wells within three miles of the tract, of which 324 are owned by coal mining companies. The other 128 wells, which include 65 wells permitted for uses related to CBM development, are permitted for the following uses:

- 33 CBM development only
- 31 livestock only
- 21 livestock and CBM development
- 17 monitoring and miscellaneous
- 10 miscellaneous and CBM development
- 7 monitoring only
- 4 livestock and domestic
- 2 livestock, miscellaneous, and CBM development

- 1 domestic only
- 1 dewatering and CBM development
- 1 miscellaneous only

For the NARO South LBA Tract, SEO data indicate that, as of July 2003, there are 433 permitted water wells within three miles of the tract, of which 338 are owned by coal mining companies. The 95 other wells, which include 57 wells permitted for uses related to CBM development, are apportioned into the following use categories:

- 39 CBM development only
- 29 livestock only
- 17 livestock and CBM development
- 4 livestock and domestic
- 2 miscellaneous only
- 1 livestock, miscellaneous, and CBM development
- 1 livestock and irrigation
- 1 livestock and miscellaneous
- 1 industrial only

SEO data indicate that, as of July 2003, there are 735 permitted water wells within three miles of the Little Thunder LBA Tract, of which 197 are owned by coal mining companies. The other 538 wells, which include 457 wells permitted for uses related to CBM development, are permitted for:

- 282 CBM development only
- 167 CBM development and livestock
- 57 livestock only
- 9 livestock and domestic
- 9 monitoring only
- 6 CBM development and miscellaneous
- 3 monitoring and miscellaneous
- 2 CBM development and livestock and miscellaneous
- 2 domestic only
- 1 monitoring, livestock, and miscellaneous

SEO data indicate that, as of July 2003, there are 488 permitted water wells within three miles of West Roundup LBA Tract, of which 260 are owned by coal mining companies. The other 228 wells, which include 156 wells permitted for uses related to CBM development, are permitted for the following uses:

- 113 CBM development only
- 35 livestock only
- 31 CBM development and livestock
- 31 monitoring only
- 9 monitoring and miscellaneous
- 3 industrial only
- 2 CBM development and livestock and miscellaneous
- 2 livestock and domestic
- 1 domestic only
- 1 miscellaneous only

SEO data indicate there are 427 permitted water wells within three miles of West Antelope LBA Tract, of which 207 are owned by coal mining companies. Permitted uses of the other 220 wells, which include 156 wells permitted for uses related to CBM development, are summarized as follows:

- 141 CBM development only

- 32 livestock only
- 23 CBM development and livestock
- 8 domestic and livestock
- 6 monitoring and miscellaneous
- 4 miscellaneous only
- 2 livestock and miscellaneous
- 1 livestock and reservoir supply
- 1 livestock, CBM development, and miscellaneous
- 1 domestic only
- 1 industrial only

SEO records have been searched for surface water rights within a half-mile radius upstream and a three-mile radius downstream of each LBA tract as applied for and the largest respective alternative tract configuration. Like the groundwater rights, this information is also required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A listing of the non-coal mine related surface water rights is presented in Appendix F.

For the NARO North LBA Tract, SEO records indicate that as of July 2003, there are 92 permitted surface water rights within the search area, of which coal mining companies hold 76. The other 16 surface water rights are for livestock watering. For the NARO South LBA Tract, SEO records indicate that as of July 2003, there are 14 permitted surface water rights within the search area, of which coal mining companies hold five. The other nine surface water rights are for livestock watering, irrigation, and wetlands.

For the Little Thunder LBA Tract, SEO records indicate that as of July 2003, there are 14 permitted surface water rights within the search area, of which coal mining companies hold six. The other eight surface water rights are for livestock watering.

For the West Roundup LBA Tract, SEO records indicate that as of July 2003, there are 20 permitted surface water rights within the search area, of which coal mining companies hold 14. The other six surface water rights are for livestock watering, irrigation, and domestic use.

For the West Antelope LBA Tract, SEO records indicate that as of July 2003, there are 33 permitted surface water rights within the search area, of which coal mining companies hold 23. The other 10 surface water rights are for livestock watering, wetlands, and temporary industrial use.

3.7 Alluvial Valley Floors

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Prior to leasing and mining, AVFs must be identified because SMCRA restricts mining activities which affect AVFs that are determined to be significant to agriculture. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. If the AVF is determined not to be significant to agriculture, or if the permit to affect the AVF was issued prior to the effective date of SMCRA, the AVF can

be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the valley will be protected.

Guidelines established by OSM and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These technical disciplines are applied as limiting criteria along three paths to identify 1) the possibility for artificial flood irrigation, 2) past and/or present flood irrigation, and 3) apparent subirrigated areas and the possibility for natural flood irrigation. Areas passing the limiting criteria are subjected to an assessment of their practical use for agriculture.

Investigations have been conducted by PRCC, TBCC, TCC, and ACC to determine the presence of AVFs within and surrounding the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines, respectively.

AVF investigations conducted within the General Analysis Area have identified AVFs that occur along Porcupine Creek, Antelope Creek, Little Thunder Creek, and North Prong Little Thunder Creek downstream of the LBA tracts (see Figure 3-10 for the general location of surface water features in the General Analysis Area). One 250-acre flood-irrigated hay meadow near the confluence of Porcupine Creek and Antelope Creek has been determined to be significant to agriculture. This hay meadow is the only flood-irrigated land identified in the SPRB General Analysis Area. No other declared AVFs or potential AVFs identified in the General Analysis Area have been determined by the WDEQ/LQD to be significant to agriculture.

The NARO North LBA Tract has been declared non-AVF by WDEQ/LQD. Portions of Porcupine Creek and its tributaries, Boss Draw and Corder Creek, cross the NARO North LBA Tract (Figure 3-10), but WDEQ/LQD has determined that no AVF lands are present within these drainages. The declared AVF on Porcupine Creek is located several miles downstream of the NARO North LBA Tract.

The NARO South LBA Tract has not yet been formally evaluated for the presence of AVFs. No unconsolidated stream laid deposits are found within the NARO South LBA Tract; therefore, it is unlikely that an AVF declaration would be made.

Approximately 2.5 acres of the 250-acre flood-irrigated AVF that has been determined to be significant to agriculture are in the North Antelope/Rochelle Complex's current permit area, within the mine's railroad spur. This AVF does lie within the North Antelope/Rochelle

Complex's anticipated permit amendment study area. A total of approximately 100 acres of declared AVF occur within the mine's railroad spur along Porcupine and Antelope Creeks, east-southeast of the NARO South LBA Tract. This AVF is outside the area of anticipated coal removal for the NARO South LBA Tract. Special measures have been designated to ensure that the mine operation will not interrupt or preclude farming on the flood-irrigated lands, and Porcupine Creek downstream from the mine's facilities will not be affected by mining.

The Little Thunder LBA Tract has been declared non-AVF by WDEQ/LQD. Portions of Little Thunder Creek and North Prong Little Thunder Creek cross the Little Thunder LBA Tract (Figure 3-10). WDEQ/LQD has declared 143 acres along the lower reach of Little Thunder Creek and 194 acres along the lower reach of North Prong Little Thunder Creek as AVFs. The declared AVFs are located several miles downstream from the Little Thunder LBA Tract and will not be affected by the planned mining and reclamation within the tract.

The West Roundup LBA Tract has not yet been formally evaluated for the presence of AVFs. A portion of Olson Draw, a tributary of Trussler Creek, which is a tributary of the Little Thunder Creek, is located on the West Roundup LBA Tract (Figure 3-10). Based on previous non-AVF declarations made on Olson Draw downstream of the West Roundup LBA Tract, it is unlikely that this channel would receive an AVF declaration upstream on the LBA tract where the drainage is smaller and AVF characteristics are negligible.

The West Antelope LBA Tract has not yet been formally evaluated for the presence of AVFs. Antelope Creek, within and extending two miles upstream from the existing Antelope Mine permit boundary, including a portion of the West Antelope LBA Tract (Figure 3-10), has been investigated for the presence of an AVF (ACC 1998). A portion of Antelope Creek within the current permit area has been designated by WDEQ/LQD as "possible subirrigated AVF of minor importance to agriculture". ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone. Portions of Spring Creek within the West Antelope LBA Tract are potential AVF due to the presence of stream laid deposits that are subirrigated; however, historical efforts at flood irrigation within the Spring Creek valley have not been successful.

Site-specific studies will be part of the mine permitting process if lease sales are held and the LBA tracts are proposed for mining. Declarations of the presence or absence of AVFs, their significance to agriculture, and the appropriate perimeters will then be made by the WDEQ/LQD. It is reasonable to assume that if the WDEQ/LQD determines AVFs are present within any of the LBA tracts that are leased, mining would be permitted because all of the proposed

lease areas consist entirely of undeveloped rangeland.

3.8 Wetlands

Waters of the U.S. is a collective term for all areas subject to regulation by the COE under Section 404 of the Clean Water Act. *Waters of the U.S.* include *special aquatic sites*, wetlands, and jurisdictional wetlands. *Special aquatic sites* are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of *special aquatic site* that includes "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(a)(7)(b)). Jurisdictional wetlands are defined as those wetlands which are within the extent of COE regulatory review. They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology. As the result of a recent Supreme Court ruling (Solid Waste Agency of Northern Cook County *v.* United States Army Corps of Engineers, January 9, 2001) non-navigable, isolated intrastate wetlands (e.g., playas) and other waters of the U.S. are not considered jurisdictional. Navigable, non-isolated wetlands and other waters of the U.S. are still considered jurisdictional by the COE.

Many wetland scientists consider areas that contain only one of the three criteria listed above as functional wetlands. The USFWS used this categorization in producing the NWI maps. These maps were produced using aerial photo interpretation, with limited field verification.

Several types of wetland systems are present within the General Analysis Area. These wetland systems are limited in size; however, the vegetation in these environments is highly productive and diverse, and provides habitat for many wildlife species. Further, the systems as a whole play important roles in controlling flood waters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands can occur in a variety of forms within the General Analysis Area. Riverine wetlands, defined by their close association with perennial streams, occur sporadically along drainages within the General Analysis Area. These areas are supported not only by the groundwater associated with the drainages, but also by periodic flooding events. Common species in these settings can include willows (*Salix* spp.), scouring rush (*Equisetum* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.) (USDA-FS 1987a).

Depressional areas that are naturally subirrigated support palustrine wetlands. These wetlands are

commonly referred to as wet meadows and support a variety of lush plant life. Common species are sedges, rushes, cordgrass (*Spartina* spp.), mint (*Mentha* spp.), and buttercup (*Ranunculus* spp.). Depressional areas that hold water may support lacustrine wetlands. When natural, these wetland areas are called playa lakes; however, man made structures such as stock ponds also may support these systems. Cattails (*Typha* spp.) and bulrush (*Scirpus* spp.) are the most common species in these systems, although lady's thumb (*Polygonum* spp.), verbena (*Verbena* spp.), and milkweed (*Asclepias* spp.) also may occur (USDA-FS 1987a).

Jurisdictional wetland inventories were completed in 1996, 1997, and 2000 by PRCC on the lands included in the NARO North and South LBA Tracts as applied for and under all alternatives, as well as the area PRCC identified as their anticipated permit amendment study area. Within just the NARO North and NARO South LBA Tracts, the area added under Alternative 2, and the anticipated disturbance area, there are an estimated 46.9 acres of waters of the U.S., based on 2002 NWI data. Jurisdictional wetlands comprise about 18.4 acres and non-jurisdictional wetlands, consisting of playas, comprise 28.5 acres of the anticipated disturbance area for both tracts.

Jurisdictional wetland inventories were completed in 2001 by TBCC on lands included in the Little Thunder LBA Tract as applied for and under all alternatives, as well as the area TBCC identified as their anticipated permit amendment study area. Based on those inventories, the Little Thunder LBA Tract and the area added by Alternative 2 include 25.36 acres of waters of the U.S., comprised of 8.59 acres of jurisdictional waters of the U.S., of which 5.19 acres are jurisdictional wetlands consisting of ephemeral riverine systems. The tract includes an additional 16.77 acres of non-jurisdictional waters of the U.S., primarily isolated stockponds, playas, and ephemeral riverine systems.

Jurisdictional wetland inventories were completed in 2002 by TCC on lands included in the West Roundup LBA Tract as applied for and under all alternatives, as well as the area identified by TCC as their anticipated permit amendment study area. The entire wetland study area includes 28.85 acres of waters of the U.S., with 6.8 acres of jurisdictional wetlands consisting primarily of aquatic beds and open water from stock ponds. The tract includes 20.21 acres of non-jurisdictional wetlands, primarily playas and ephemeral riverine drainages.

Jurisdictional wetland inventories were completed in 2002 by ACC on lands contained within the West Antelope LBA Tract as applied for and under all alternatives as well as the area that would be disturbed by mining as part of the existing mine operations. The entire wetland study area includes 33.52 acres of waters of the U.S., with 31.77 acres of jurisdictional wetlands consisting of aquatic beds, open water from

stockponds, and intermittent stream beds. No non-jurisdictional wetlands were identified in the wetland study area.

The presence of jurisdictional wetlands on a mine property does not preclude mining. Jurisdictional wetlands must be identified and special permitting procedures are required to assure that after mining there will be no net loss of wetlands. A wetland delineation must be completed according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. Formal wetland delineations have been confirmed by COE for some of the wetlands included in the proposed LBA tracts, but wetland inventories covering portions of the LBA tracts have not yet been submitted to COE for verification. These wetland inventories will be submitted to COE for verification as part of the mine and reclamation permit process. In Wyoming, once the delineation has been verified, it is made a part of the mine permit document. The reclamation plan is then revised to incorporate at least equal types and number of jurisdictional wetlands. Section 404 of the Clean Water Act does not cover non-jurisdictional or functional wetlands; however, Executive Order 11990 requires that all federal agencies protect all wetlands. Non-jurisdictional and functional wetlands are restored as required by WDEQ/LQD (depending on the values associated with the wetland features), by the surface managing agency (on public land), or by the private landowner. There are public lands administered by USDA-FS included in the NARO North, Little Thunder, and West Roundup LBA Tracts.

3.9 Vegetation

Numerous baseline vegetation surveys associated with surface mining operations have been conducted within the General Analysis Area. Vegetation surveys of the General Analysis Area have been conducted by Intermountain Resources of Laramie, Wyoming, BKS Environmental Associates, Inc. of Gillette, Wyoming, and Ecologic of Bakersfield, California. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's alternative tract configuration, and the applicant mine's anticipated permit amendment study area.

The vegetation of the General Analysis Area consists of species common to eastern Wyoming. The following vegetation types were identified within the General Analysis Area:

- Agriculture
- Alkali Bottomland Grass
- Alkali Shrubland
- Big Sagebrush Draw
- Big Sagebrush Upland
- Big Sagebrush Shrubland
- Big Sagebrush Grassland
- Birdsfoot Sagebrush Upland
- Blue Grama Upland
- Blue Grama Roughland
- Breaks Grassland
- Cropland
- Cultivated Pastureland

- Densely Vegetated Playa
- Disturbed Lands
- Grassy Bottom
- Greasewood Grassland
- Greasewood Lowland
- Meadow Grassland
- Mixed Grass Prairie
- Mixed Sandy Upland
- Pastureland
- Hayland
- Playa Barrens
- Playa Grassland
- Reclaimed Lands
- Reservoir/Stockpond
- Riparian
- Rough Breaks Shrublands
- Salt Grassland
- Sandy Saline Meadow
- Scoria Grassland
- Silver Sagebrush Lowland
- Silver Sagebrush
- Sparsely Vegetated Playa
- Spicebush Playa
- Spikerush Playa
- Streamside Meadow
- Treated Grazing Land
- Upland Grassland
- Wet Meadow/Water/Riparian

The vegetation of the General Analysis Area varies from sagebrush and grassland-dominated uplands to the heavily vegetated riparian areas and stream terraces. The predominant vegetation types, in terms of total acres or occurrence, are the sagebrush and grassland types, which occur on approximately 65 percent of the lands inventoried in the General Analysis Area. Other common plant species on the level uplands include western wheatgrass, needleandthread grass, and plains pricklypear. On the stream terraces, common species include blue grama, silver sagebrush, and greasewood. Spicebush, foxtail barley, and inland saltgrass occur near and around playas. Within the bottomlands and riparian areas are mixtures of western wheatgrass, Kentucky bluegrass, and sedges. Cottonwood trees varying in density and extent occur within some of the larger stream valleys. Blue grama, big sagebrush, and bluebunch wheatgrass occur on the ridges and rougher areas. The occurrence and relative distribution of the dominant vegetation types is shown in Table 3-7.

3.9.1 Threatened, Endangered, Proposed, and Candidate Plant Species, USDA-FS Region 2 Sensitive Species, and BLM Sensitive Species

Refer to Appendices G through K.

3.10 Wildlife

Background information on wildlife in the General Analysis Area was drawn from several sources, including:

- FEIS for the North Jacobs Ranch Coal Lease Application (BLM 2001b);
- FEIS for the Horse Creek Coal Lease Application (BLM 2000a);
- FEIS for the Powder River Coal and Thundercloud Coal Lease Applications (BLM 1998);
- FEIS for the North Rochelle Coal Lease Application (BLM 1997b);
- FEA for the Antelope Coal Lease Application (BLM 1995);

Table 3-7. Dominant Vegetation Types in the General Analysis Area.

Vegetation Types	Acreage	Percentage
Grassland	14,674	33.40
Big Sagebrush	14,075	32.00
Breaks Grassland	3,894	8.90
Playa Barrens	2,119	4.80
Disturbed Areas	1,907	4.30
Meadows/Riparian	1,828	4.20
Greasewood	1,530	3.50
Pasture/Hayland	1,190	2.70
Saline Grasslands	1,135	2.60
Agriculture	649	1.50
Birdsfoot Sagebrush	280	0.64
Silver Sagebrush	256	0.60
Playa Grasslands	252	0.76
Reservoirs/Stockponds	154	0.40
Reclaimed Land	40	0.09
Total	**43,983**	**100.00**

- FEIS for the West Black Thunder Coal Lease Application (BLM 1992a);
- Wyoming Natural Diversity Database (University of Wyoming 2001);
- WGFD and USFWS records; and
- personal contacts with WGFD and USFWS biologists.

Site-specific data for the proposed lease areas were also obtained from WDEQ/LQD permit applications and annual wildlife reports for the applicant mines. Baseline and annual monitoring surveys cover large perimeters around each mine's current permit areas. Consequently, a majority of the LBA tracts as applied for under the Proposed Actions, BLM's alternative tract configurations, and the applicant mines' anticipated permit amendment study areas have been surveyed during baseline and annual wildlife surveys for the Jacobs Ranch, Black Thunder, North Rochelle, North Antelope/Rochelle Complex, and Antelope Mines. In addition, PRCC conducted wildlife baseline investigations in 2000 on the NARO North and NARO South LBA Tracts as proposed, the area added by Alternative 2, and areas within a two-mile radius. TBCC conducted wildlife baseline investigations in 2002 on the Little Thunder LBA Tract as proposed, the area added by Alternative 2, and areas within a two-mile radius. TCC conducted wildlife baseline investigations in 2002 on the West Roundup LBA Tract as proposed, the areas added by Alternative 3, and

areas within a two-mile radius. ACC initiated wildlife baseline investigations in 2003 on the West Antelope LBA Tract as proposed, the area added by Alternative 2, and areas within a two-mile perimeter, and will complete the baseline survey in 2004. The results of site-specific surveys for the entire proposed lease areas and appropriate perimeters will be part of the mine permitting process if lease sales are held and the tracts are proposed for mining.

The General Analysis Area consists primarily of uplands. The topography is relatively level to gently sloping, except along some of the drainages where channel incision has created some steeper slopes and gullying.

All of the vegetation types listed in the vegetation section provide habitat for some wildlife species. In an undisturbed condition, the major vegetation types in the General Analysis Area provide high quality habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Wildlife habitat types include sagebrush-grassland, upland grassland, seeded grassland, bottomland grassland, and riparian areas. The predominant habitat is sagebrush-grassland, which consists mostly of big sagebrush, western wheatgrass, needleandthread, prairie junegrass, sandberg bluegrass, blue grama, and cheatgrass brome. The upland grassland or mixed-grass prairie is the next largest habitat type and it consists mostly of needleandthread, western wheatgrass, prairie junegrass, six-weeks-grass, cheatgrass brome, and fluffweed. Seeded grassland is dominated by crested wheatgrass, but older seedings have a mixture of less dominant species including needleandthread, fringed sagewort, prairie junegrass, threeawn, and big sagebrush. Bottomland grassland and riparian habitat is limited to corridors along Antelope Creek, Spring Creek, Horse Creek, Porcupine Creek, Trussler Creek, West School Creek, Little Thunder Creek, North Prong Little Thunder Creek, and some of the larger tributaries of these streams. Vegetation common to these areas includes Kentucky bluegrass, western wheatgrass, blue grama, green needle grass, mutton bluegrass, sedges, foxtail barley, Japanese brome, alkali bluegrass, and poverty weed.

Several playas dominated by western wheatgrass are scattered throughout the General Analysis Area. Very few trees are present in the General Analysis Area with the exception of some stands of cottonwood along Antelope Creek and a few isolated cottonwoods along some of the larger drainages.

An occasional rough breaks habitat is found within the General Analysis Area and is distinguished by the irregularity of vegetation, slopes, and soils. Vegetation on the rough breaks is typically sparse and comprised mostly of western wheatgrass, needleandthread, blue grama, broom snakeweed, rubber rabbitbrush,

wildbuckwheat, birdfoot sagewort, and big sagebrush.

All streams are ephemeral or intermittent, but a few persistent pools are often present in their channels. Development of CBM resources in the area west of and within the General Analysis Area could potentially increase surface flows in some drainages and fill reservoirs, ponds, and playas, resulting in an increase in habitat for waterfowl, shorebirds, and aquatic species.

3.10.1 Big Game

The four big game species that are expected to occur in suitable habitat throughout the General Analysis Area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus)*, and elk (*Cervus elaphus*). No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are the most common big game species in this area. This species is most abundant in the upland grassland or mixed-grass prairie habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the mines, although a large portion of pronghorn are observed during winter surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed six miles. Pronghorn make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the General Analysis Area as yearlong and winter/yearlong pronghorn range. The WGFD Cheyenne River Herd Unit encompasses the majority of the General Analysis Area, while a small part of the area is included the WGFD Hilight Herd Unit. In post-season 2002, the WGFD estimated the Cheyenne River Herd Unit to be 34,146 animals with an objective of 38,000. The WGFD estimated the 2002 post-season population of the Hilight Herd Unit to be approximately 11,000 animals, which is at the objective of 11,000 (WGFD 2002).

Mule deer use nearly all habitats, but prefer sagebrush grassland, rough breaks, and mixed-grass prairie. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). This species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. The WGFD has classified most of the General Analysis Area as out of the normal mule deer use range, although areas that roughly follow the predominant stream channels are classified as yearlong range and some winter/yearlong

range is found near Antelope Creek in Converse County. The entire area is located within the WGFD Thunder Basin Mule Deer Herd Unit. No crucial or critical mule deer ranges or migration corridors occur on or within several miles of any of the LBA tracts in the General Analysis Area.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer prefer riparian habitats and are therefore seldom observed in the General Analysis Area due to the lack of that particular habitat. WGFD classifies the entire General Analysis Area, with the exception of a narrow corridor along Antelope Creek, as out of the normal white-tailed deer use range. White-tailed deer are occasionally recorded along Antelope Creek, which is classified as yearlong range.

Elk reside in the Rochelle Hills that border the eastern edge of the General Analysis Area. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands within the General Analysis Area, although none of the area is classified by the WGFD as an elk use area. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately five square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994).

3.10.2 Other Mammals

A variety of small and medium-sized mammal species occur in the vicinity of the General Analysis Area. These include predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, and prairie dogs) and lagomorphs (jackrabbits and cottontails). These species are cyclically common and widespread throughout the region (Commonwealth 1980, Powder River Eagle Studies 1987-1999). Porcupines and bats (hoary and big brown) have also been recorded. The prey species are important for raptors and other predators.

Surveys have been conducted to locate prairie dog colonies on and within one-half mile of the proposed lease areas, current mine permit areas and anticipated permit amendment study areas in the General Analysis Area.

There are six prairie dog towns located on or within one-half mile of the two NARO LBA tracts. No colonies were observed on the NARO North LBA Tract and one colony is within a half-mile radius of that tract. Three colonies were observed on the NARO South LBA Tract and two others are within a half-mile radius of

that tract. No colonies were observed on the area added to the NARO South tract under Alternative 2.

Recent surveys indicate prairie dog colonies are not located on or within one-half mile of the proposed lease area for the Little Thunder LBA Tract or the area added under Alternative 2.

Recent surveys found no prairie dog colonies located within the West Roundup LBA Tract. One small colony is located within the area added under Alternatives 2 and 3. One other colony is located just over one-half mile south of the LBA tract.

Four black-tailed prairie dog colonies have been inventoried on and within one-half mile of the West Antelope LBA Tract and Alternative 2 area. Two colonies are included in, or overlap the proposed lease area; one in the north-central part and one in the south-central part of the LBA tract as applied for under the Proposed Action. A third colony covers roughly 2.5 acres in the southwestern corner of the lands added by Alternative 2. The fourth colony is on an existing lease at the Antelope Mine just east of the LBA tract and has been disturbed by the Antelope Mine operations.

Additional discussion of prairie dog colonies identified on the LBA tracts is included in Appendices G through K of this EIS.

3.10.3 Raptors

Common raptor species expected to occur in suitable habitats in the General Analysis Area include golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*). Those species that commonly nest in the General Analysis Area are the ferruginous hawk, golden eagle, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species are adapted to nesting on the ground, creek banks, buttes, or rock outcrops. Over time, natural forces have destroyed many nests, while others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations at these mines.

As of a survey that was completed in 2000, there were 77 intact raptor nests within the NARO North and NARO South LBA Tracts and a two-mile radius area, 45 of which were active.

After the 2001 breeding season 63 known nests were intact within Black Thunder Mine's current raptor survey area, which includes the current Black Thunder Mine permit area and a two-mile radius area.

After the 2001 breeding season, 28 known nests were intact within the West Roundup LBA Tract raptor survey area, which includes the West Roundup LBA Tract, areas added under Alternatives 2 and 3, and a two-mile perimeter. One of those intact nests is within the LBA tract as proposed, one nest is within the area added under Alternative 3, and the other 26 nests are in the two-mile perimeter survey area.

At the end of 2000, there were 42 intact raptor nests within the raptor survey area for the West Antelope LBA Tract, which includes the tract as proposed, lands added by Alternative 2, and a two-mile radius. Nine nests in the survey area were occupied: seven on the LBA tract as proposed and two on the lands added under Alternative 2.

3.10.4 Game Birds

A few upland game birds are known to regularly occur in suitable habitats in the General Analysis Area. The species include mourning doves (*Zenaida macroura*), sage grouse (*Centrocercus urophasianus*), and wild turkeys (*Meleagris gallopavo*). The gray partridge (*Perdix perdix*) and the sharp-tailed grouse (*Tympanuchus phasianellus*) have also been observed sporadically in the vicinity of the General Analysis Area.

The sage grouse is a yearlong resident and the most common upland game bird species in the area. USFWS has received several petitions to list the sage grouse under the ESA. The causes of the range-wide decline in sage grouse population levels are not completely understood, but they may be influenced by local conditions. However, habitat loss and degradation, as well as loss of population connectivity are important factors (Braun 1998, Wisdom et al. 2002).

Following the deaths of 11 sage grouse in northeastern Wyoming from West Nile virus in August and early September 2003, the Wyoming Game and Fish Commission announced on September 11 that the 2003 hunting season for the species in Johnson, Sheridan, and Campbell Counties would be closed. According to a press release, the commission took this action because the infection is much higher in northeastern Wyoming than the rest of the state and the area is on the fringe of sage grouse range with marginal, fragmented habitat (WGFD 9/11/2003 press release).

Sage grouse are dependent on sagebrush. Population and habitat analyses suggest that wintering habitat can be as limiting as mating and breeding habitats.

SPRB mining companies conduct surveys of sage grouse lek, or strutting ground, attendance and surveys to identify new sage grouse leks in the spring as part of the annual wildlife surveys that are conducted for each mine. These surveys, which include the mine permit area and a one-mile perimeter, were initiated when the mines were initially permitted, generally in the mid-1980s. As a result, most of the area included in each of the proposed

LBA tracts has been included in previous annual survey areas for each of the SPRB mines. In May 2002, the USFWS office in Cheyenne, Wyoming released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming,* which replaced the previous Migratory Birds of High Federal Interest List. The greater sage grouse is included on the new list and, as a result, the presence of sage grouse and sage grouse sign are included in the annual migratory bird surveys that are conducted for each mine in both spring and summer. These surveys cover the mine's permit area and a one-half mile perimeter.

As discussed below, five sage grouse leks have been surveyed within the General Analysis Area. Two of the leks have been active during recent survey years, and three of the leks have not been attended by grouse in the spring for several years. Overall, the sage grouse population appears to be steadily declining. Disturbance of leks, nesting areas, and brood-rearing areas are key threats to this species in the General Analysis Area.

The sage grouse is a yearlong resident in the general North Antelope/ Rochelle Complex area and is found on lands within and adjacent to the NARO North and NARO South LBA Tracts; however, no historic or active sage grouse leks are located on or within approximately 1.3 miles of the NARO North tract as proposed and approximately 4.5 miles of the NARO South tract as proposed. Four sage grouse leks (Wilson, Rochelle, Kort, and Payne) have been discovered in the wildlife monitoring survey area for the North Antelope/Rochelle Complex. These four leks, which are all located in the eastern portion of the mine's current permit area, comprise the Rochelle lek complex. The Wilson and Rochelle leks have not been attended since 1997 and 1999, respectively, although the Kort and Payne leks are currently active. The Kort lek, which is located 3.5 miles east-southeast of the NARO North tract in the SE¼ SW¼ of Section 31, T.42N., R.69W., was first identified in spring 1998. Male attendance on the Kort lek has fluctuated between peaks of 13 in 2000 to four in spring 2003. For unknown reasons, grouse apparently shifted their breeding activities from the Wilson lek and formed the Kort lek. The Payne lek, which is located approximately 1.3 miles east of the NARO North LBA Tract in the NE¼ NW¼ of Section 26, T.42N., R.70W., was discovered in spring 2001. The Payne lek hosted peak male counts of 21, 18, and 7 in 2001, 2002, and 2003, respectively. The Payne lek now appears to be the primary lek for the Rochelle lek complex (TWC 2003).

The sage grouse is a yearlong resident in the general Black Thunder Mine area but does not appear to frequent the Little Thunder LBA Tract. One sage grouse lek was discovered on the Black Thunder Mine permit area in 1984. Annual monitoring of that lek, known as the Black Thunder lek, began in 1985 and has continued to the present. The Black Thunder lek is approximately 2,000 ft southeast of the LBA tract as proposed. In 2001, for the eighth consecutive year, no

grouse were observed at the former Black Thunder lek.

The Black Thunder lek, discussed above, is located approximately one-half mile north of the West Roundup LBA Tract. As indicated above, the lek has been abandoned since 1994. No new leks were found and no sage grouse were observed during a survey conducted during the spring of 2001 in the North Rochelle Mine permit area and a one-mile perimeter.

Sage grouse are not common in the vicinity of the West Antelope LBA Tract wildlife study area or the adjacent Antelope Mine. The lack of use of this area by sage grouse has been documented since the late 1970s. No sage grouse leks have been observed on or near the Antelope Mine during baseline studies (1978-1979) or the mine's annual wildlife monitoring surveys (1982-2000), which included the eastern 73 percent of the LBA tract as proposed and the entire Alternative 2 area. The nearest known lek is approximately five miles southeast of the West Antelope LBA Tract.

3.10.5 Migratory Bird Species of Management Concern in Wyoming

Table 3-8 is the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, which USFWS will use for reviews related to existing and proposed coal mine leased land (USFWS 2002). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski, et al. 2000). The *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming* replaced the Migratory Birds of High Federal Interest (MBHFI) list. SPRB mining companies previously conducted annual surveys for the species included on the MBHFI list and now conduct annual surveys for the species included on the new list. The surveys, which are conducted in the spring and summer, include the permit area for each mine and a one-half mile perimeter. Table 3-8 includes the regional status and expected occurrence, historical observations, and breeding records on and near the SPRB Coal LBA Tracts for each of the species on the list, based on a compilation of the results of the annual surveys. Depending on the location, between 19 and 21 of the listed species have historically been observed within the General Analysis Area. The species commonly observed nesting in the area include the ferruginous hawk, burrowing owl, Brewer's sparrow, lark bunting, Swainson's hawk, McCown's longspur, and vesper sparrow. The mountain plover, upland sandpiper, short-eared owl, loggerhead shrike, chestnut-collared longspur, grasshopper sparrow, and the greater sage grouse do not have abundant nesting habitat available, but have been documented to nest within the General Analysis Area. Additional information about the observed occurrence of the mountain plover on the five LBA tracts can be found in Appendices G through K.

The bald eagle is seasonally common and most frequently observed during the winter months. The burrowing owl is common and classified as a

Table 3-8. 40 Migratory Bird Species of Management Concern in Wyoming for Coal Mines: Their Regional Status, and Expected and Actual Occurrence on or Near the SPRB Coal LBA Tracts.

Species	Seasonal Status/Breeding Records in Northeastern WY[1]	Expected Occurrence on and in Vicinity of the LBA Tracts[2]	Historical Sighting Records and Breeding Status in Vicinity of the LBA Tracts[3]
LEVEL I (species need conservation action)			
Mountain plover*	Summer/Breeder	Uncommon	None-Few sightings
Greater sage-grouse*	Resident/Breeder	Uncommon	Uncommon breeder
McCown's longspur*	Summer/Breeder	Common	Occasional-Common breeder
Baird's sparrow*	Summer/Observed	Rare	None-Few sightings
Ferruginous hawk*	Summer/Breeder	Common	Common breeder
Brewer's sparrow*	Summer/Breeder	Common	Common breeder
Sage sparrow	Summer/Breeder	Not Expected	None
Swainson's hawk	Summer/Breeder	Common	Common breeder
Long-billed curlew*	Summer/Observed	Uncommon	Few sightings, potential migrant
Short-eared owl*	Summer/Breeder	Uncommon	Few sightings, potential breeder
Peregrine falcon	Resident/Observed	Uncommon Migrant	None
Burrowing owl*	Summer/Breeder	Common	Recent common breeder
Bald eagle*	Resident/Breeder	Seasonally Common	Frequent in winter
Upland sandpiper*	Summer/Breeder	Uncommon	Few sightings, potential breeder
LEVEL II (species need monitoring)			
Cassin's kingbird	Never Recorded	Not Expected	None
Lark bunting*	Summer/Breeder	Common	Common breeder
Dickcissel*	Summer/Observed	Rare	None-Few Sightings
Chestnut-collared longspur*	Summer/Breeder	Common	Occasional breeder
Black-chinned hummingbird	Never Recorded	Not Expected	None
Pygmy nuthatch	Never Recorded	Not Expected	None
Marsh wren	Never Recorded	Not Expected	None
Western bluebird	Summer/Breeder	Not Expected	None
Sage thrasher	Summer/Breeder	Uncommon	Uncommon breeder
Grasshopper sparrow*	Summer/Breeder	Uncommon	Few sightings, potential breeder
Bobolink	Summer/Observed	Rare	None
Common loon*	Summer/Observed	Not Expected	None-Few Sightings
Black-billed cuckoo	Never Recorded	Not Expected	None
Red-headed woodpecker	Summer/Breeder	Uncommon	None
Yellow-billed cuckoo	Summer/Observed	Very Rare	None
Eastern screech-owl	Never Recorded	Not Expected	None
Western screech-owl	Never Recorded	Not Expected	None
Western scrub-jay	Never Recorded	Not Expected	None
Loggerhead shrike*	Summer/Breeder	Uncommon	Occasional breeder
Vesper sparrow	Summer/Breeder	Common	Common breeder
Lark sparrow*	Summer/Breeder	Uncommon	Few sightings
Ash-throated flycatcher	Summer/Observed	Not Expected	None
Bushtit	Never Recorded	Not Expected	None
Merlin*	Resident/Observed	Uncommon	Few sightings
Sprague's pipit	Never Recorded	Not Expected	None
Barn owl	Summer/Observed	Very Rare	None

[1] Compiled from Luce, et al. (1999), for extreme southern Campbell and northern Converse Counties.
[2] Expected occurrence in the study area was based on range, history of occurrence, and habitat availability.
[3] Sighting records were derived from actual occurrence on or within one-half mile of the LBA tracts and anticipated permit amendment study area.
* Species marked with an asterisk have historically been recorded during baseline or monitoring surveys for the four applicant mines.

recent common breeder in the General Analysis Area. Sage grouse, recently added to the Level 1 list, is uncommon in the General Analysis Area and is classified as an uncommon breeder. Additional information about the observed occurrence of the bald eagle on the five LBA tracts can be found in Appendices G through K.

Suitable nesting habitat is scarce if not absent in the General Analysis Area for the remainder of the Migratory Bird Species of Management Concern in Wyoming. The other species that are listed in Table 3-8 have rarely or never been recorded in the General Analysis Area.

3.10.6 Other Species

Wildlife surveys within the General Analysis Area have documented numerous other wildlife species that inhabit the region, including various nongame birds, waterfowl, shorebirds, herptiles, and nongame fish. All these species are generally common inhabitants of the area and none are of specific concern to state or federal agencies.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the General Analysis Area. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. Fish surveys were conducted during baseline studies for the North Antelope and Rochelle Mines in the late 1970s, for the North Rochelle Mine in 1980-1981, for the Antelope Mine in the late 1970s and in 1998 (for the Horse Creek lease), and for the Little Thunder LBA Tract in 2002. Additional discussion of fisheries and baseline studies on the LBA tracts is included in Appendix K.

Fish species are not normally found on the NARO North and NARO South LBA Tracts, due to the ephemeral nature of the drainages on these tracts. It is possible that some fish species, such as fathead minnow or black bullhead, could exist in some of the deeper pools on Porcupine Creek, but their existence has not been documented and the tendency of these pools to go dry during drought periods makes the presence of fish unlikely.

Aquatic habitat is very limited on the Little Thunder LBA Tract. The principle drainages in the study area are Little Thunder Creek and North Prong Little Thunder Creek, which are ephemeral, under natural conditions, and are not known to support fisheries this far up the drainage. Recent CBM development has created a perennial flow in Little Thunder Creek and its tributaries. In addition, Little Thunder Reservoir, which is located on Little Thunder Creek upstream of the Little Thunder LBA Tract in Section 22, T.43N., R.71W., has historically maintained and currently maintains both game and non-game fisheries.

Aquatic habitat is very limited on the West Roundup LBA Tract. The principle drainages in the study area

are Trussler Creek and Olson Draw, which are ephemeral, under natural conditions, and do not support fisheries.

Aquatic habitat is limited in the West Antelope LBA Tract study area. Antelope Creek is an intermittent stream where it crosses the LBA tract. The other principal drainage on the tract is Spring Creek, which is an ephemeral drainage. Baseline aquatic studies for the Antelope Mine (Commonwealth Associates, Inc. 1980) found three common species in Antelope Creek at the confluence of Spring Creek and Antelope Creek, which is on the LBA tract. These species are: the sand shiner (*Notropis stramineus*), fathead minnow (*Pimephales promelas*), and plains killifish (*Fundulus kansae*). The fathead chub (*Platygobio gracilus*), which is listed by Region 2 of the USDA-FS as a Sensitive Species (Appendix K), has been recorded in Antelope Creek, downstream of the West Antelope LBA Tract (Commonwealth Associates, Inc. 1980, Wechse et al. 1978), but has not been recorded in the vicinity of the tract. Horse Creek, located east of the West Antelope LBA Tract, was sampled in 1998 during baseline studies for the Horse Creek lease tract, and the green sunfish (*Lepomis cyanellus*) was the only species caught.

As discussed above, produced water from CBM wells has created perennial flow in Little Thunder Creek, and may create perennial flows in some of the other naturally ephemeral drainages in the General Analysis Area. This may increase habitat for waterfowl and aquatic species while CBM production continues.

3.10.7 Threatened, Endangered, Proposed, and Candidate Animal Species, USDA-FS Region 2 Sensitive Species, and BLM Sensitive Species

Refer to Appendices G through K.

3.11 Ownership and Use of Land

Land ownership within the General Analysis Area consists of private lands intermingled with federal lands. Table 3-9 summarizes the distribution of surface ownership for each LBA tract, including the tract and the entire study area BLM is evaluating in the alternatives for each tract. Federally owned lands in the General Analysis Area include portions of the TBNG administered by the USDA-FS. Livestock grazing on native rangeland is the primary land use, while oil and gas production, wildlife habitat, and recreation are secondary land uses for both public and private lands. Surface ownership for each LBA tract is shown in Figures 3-11 through 3-14.

Areas of disturbance within and near the five proposed lease areas include roads, oil and gas wells and associated production facilities, and surface mine-related facilities and activities. State Highways 59 and 450 are in the vicinity of the LBA tracts. Several paved county roads traverse and provide public and private access within the General Analysis Area. These include County

Table 3-9. Distribution of Surface Ownership Within Each LBA Tract and Study Area.

	Federal Ownership		Private Ownership	
LBA Tract	**(Acres)**	**(Percent)**	**(Acres)**	**(Percent)**
NARO North (As Proposed)	1,718.6	9.8	650.8	3.7
NARO South (Alternative 2)	0.0	0.0	3,201.8	18.2
Little Thunder (Alternative 2)	1,100.7	6.3	3,982.8	22.7
West Roundup (Alternative 3)	1,257.1	7.2	1,783.1	10.1
West Antelope (Alternative 2)	0.0	0.0	3,877.9	22.1
Totals	**4,076.4**	**23.3**	**13,496.4**	**76.7**

Road 37, Antelope Road, Reno Road, and Edwards Road.

The oil and gas estate within the LBA tracts is both federally and privately owned, with the majority (approximately 67 percent) being federally owned. Most of the federally owned oil and gas estate is leased. The ownership of the oil and gas estate for each LBA tract is shown in Figures 3-15 through 3-18. Lists of the current federal oil and gas lessees for each tract are shown in Tables 3-10 through 3-13.

There are 35 permitted conventional oil and gas wells on lands included in the LBA tracts as proposed and the lands added under BLM's alternatives (Figures 3-15 through 3-18). Of these, 25 wells are plugged and abandoned or shut in and 10 wells are still producing. Of the 10 producing wells, six are on federal oil and gas leases and four are on private leases. All of the conventional oil and gas wells within the LBA tract configurations were originally drilled between 1968 and 1989.

The Supreme Court has ruled that the CBM belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBM as well as conventional oil and gas on the LBA tracts.

CBM development is most extensive in the northwestern portion of the General Analysis Area. When the Draft SPRB Coal EIS was prepared, only the Little Thunder LBA Tract included CBM wells that were producing. As of October 2003, producing CBM wells were also present on the West Roundup and NARO North LBA Tracts, under the Proposed Action and/or Preferred Alternatives for those tracts. There is CBM drilling and production activity in the general vicinity of the NARO South and West Antelope LBA Tracts, but no wells are currently producing in the area included under the Proposed Action or Preferred Alternatives for these tracts. According to the WOGCC records as of October 6, 2003, there are approximately 285 CBM wells that are capable of production on or in sections adjacent to the proposed tracts. These wells are listed in Appendix L.

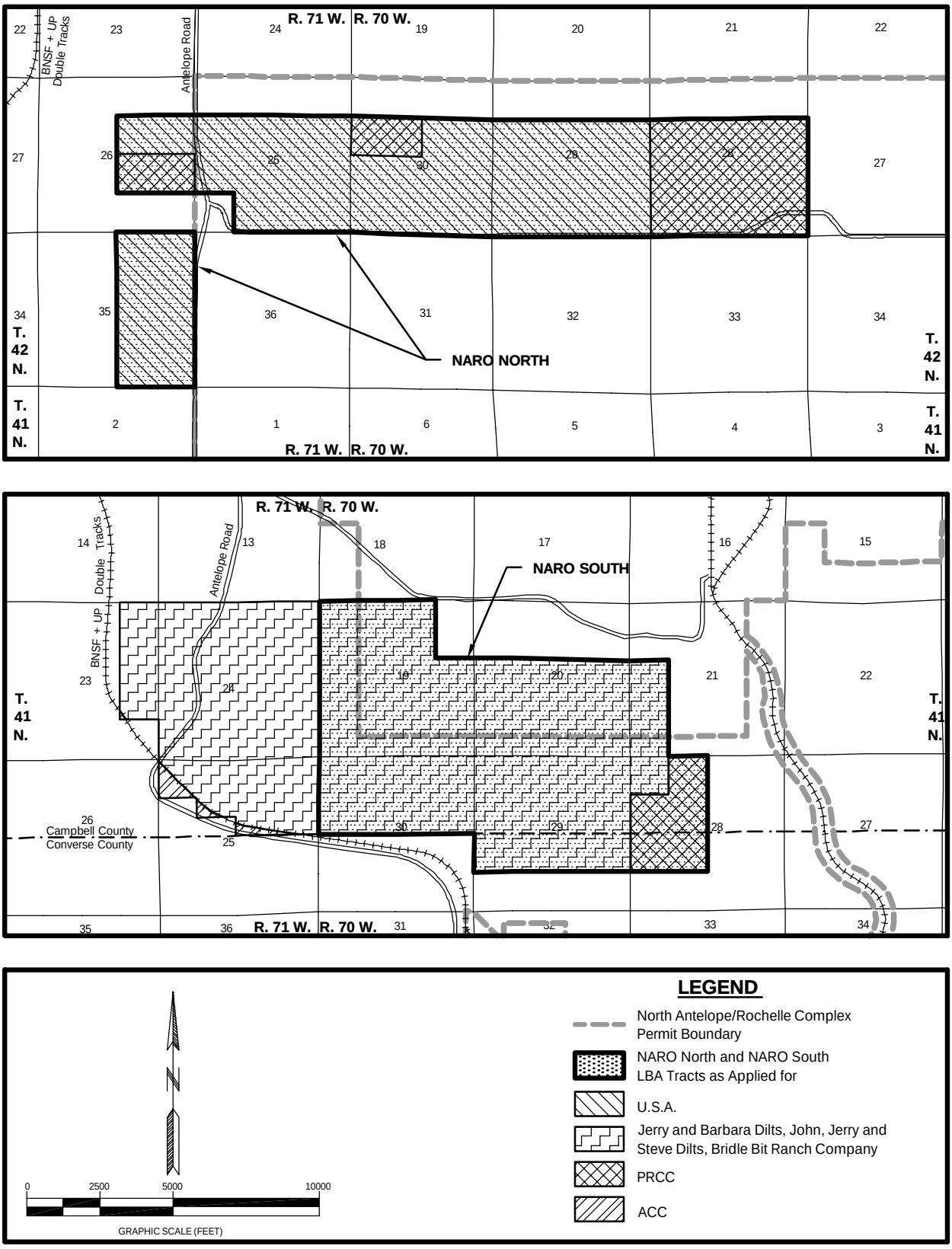

Figure 3-11. Surface Ownership Within the NARO North and NARO South LBA Tracts.

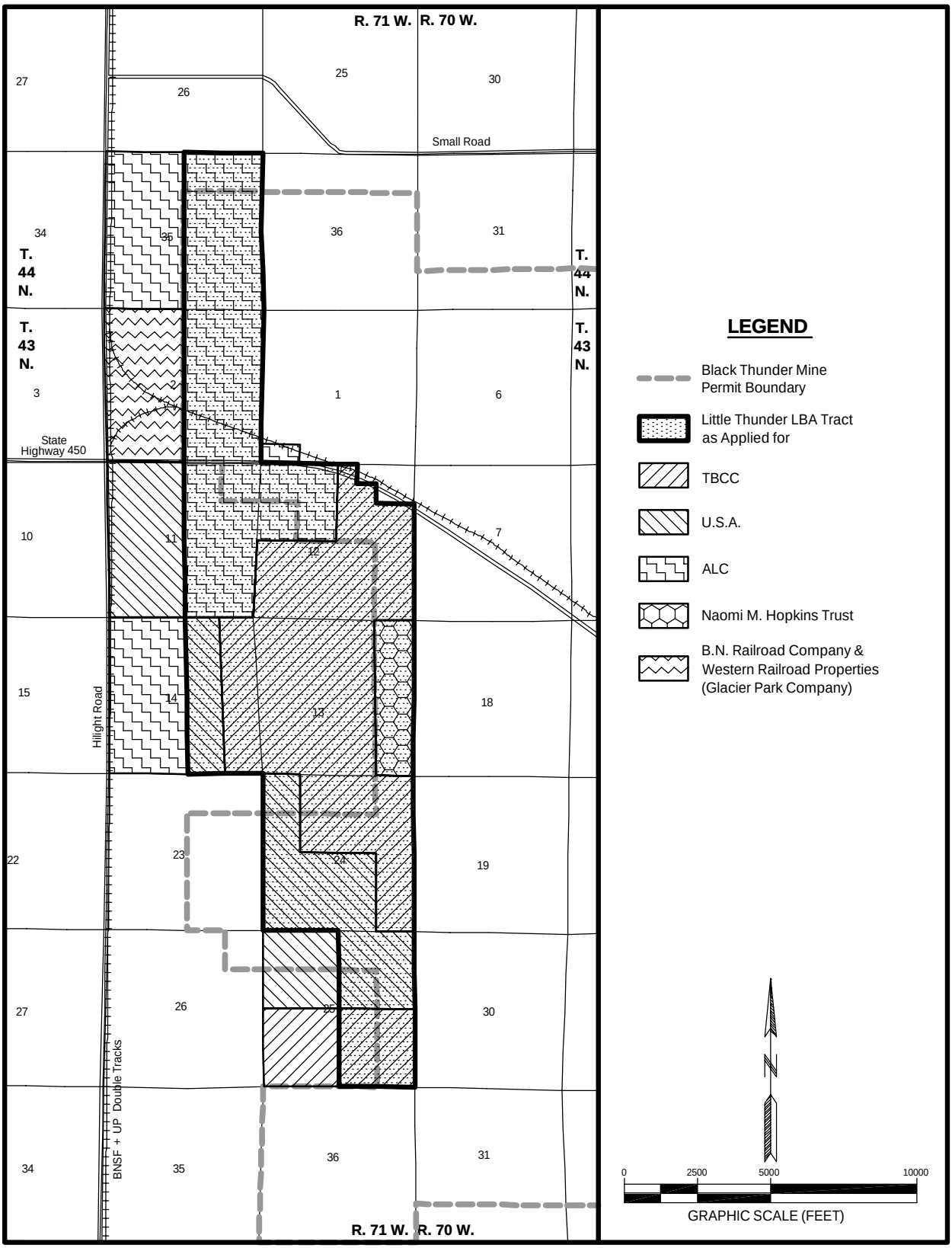

Figure 3-12. Surface Ownership Within the Little Thunder LBA Tract.

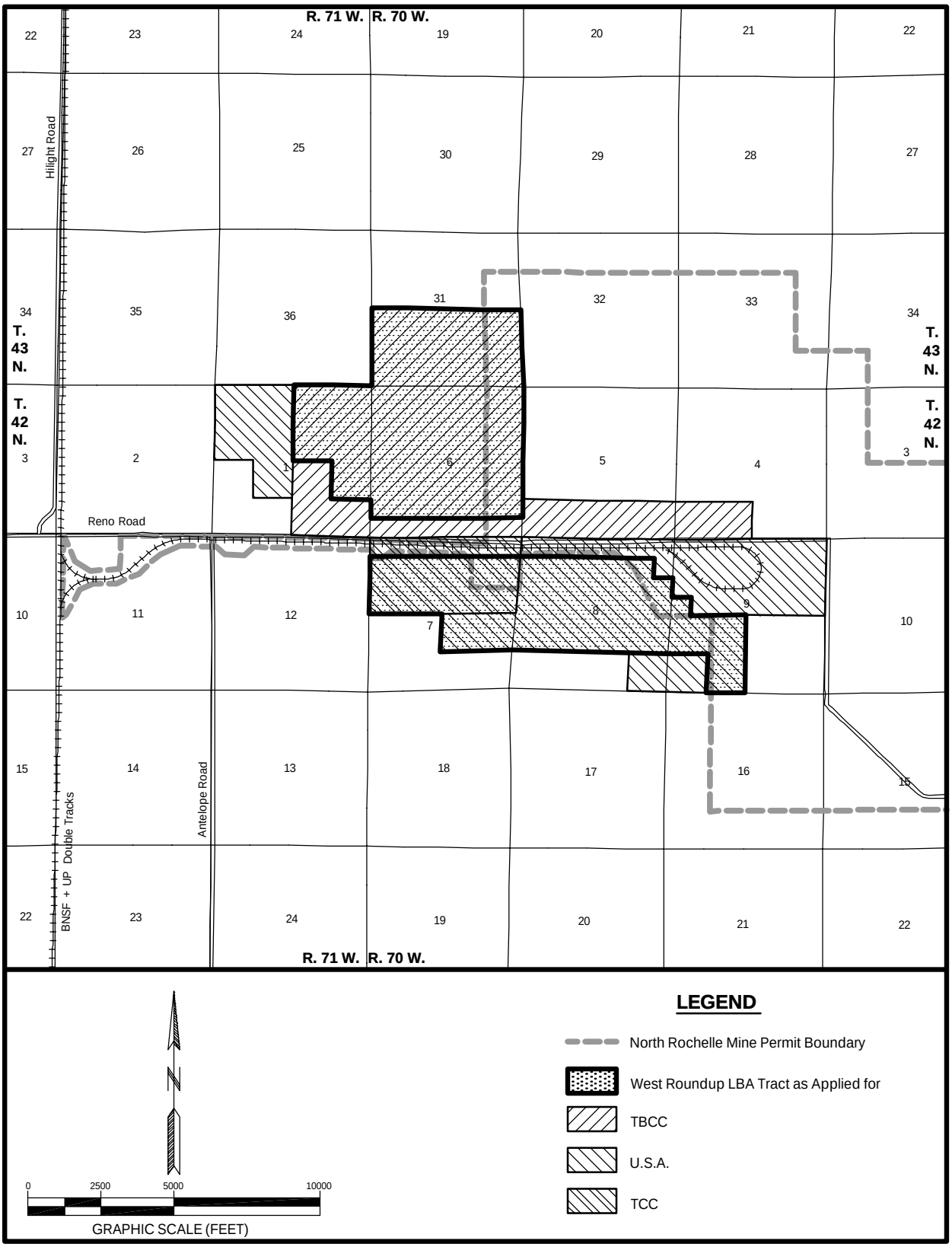

Figure 3-13. Surface Ownership Within the West Roundup LBA Tract.

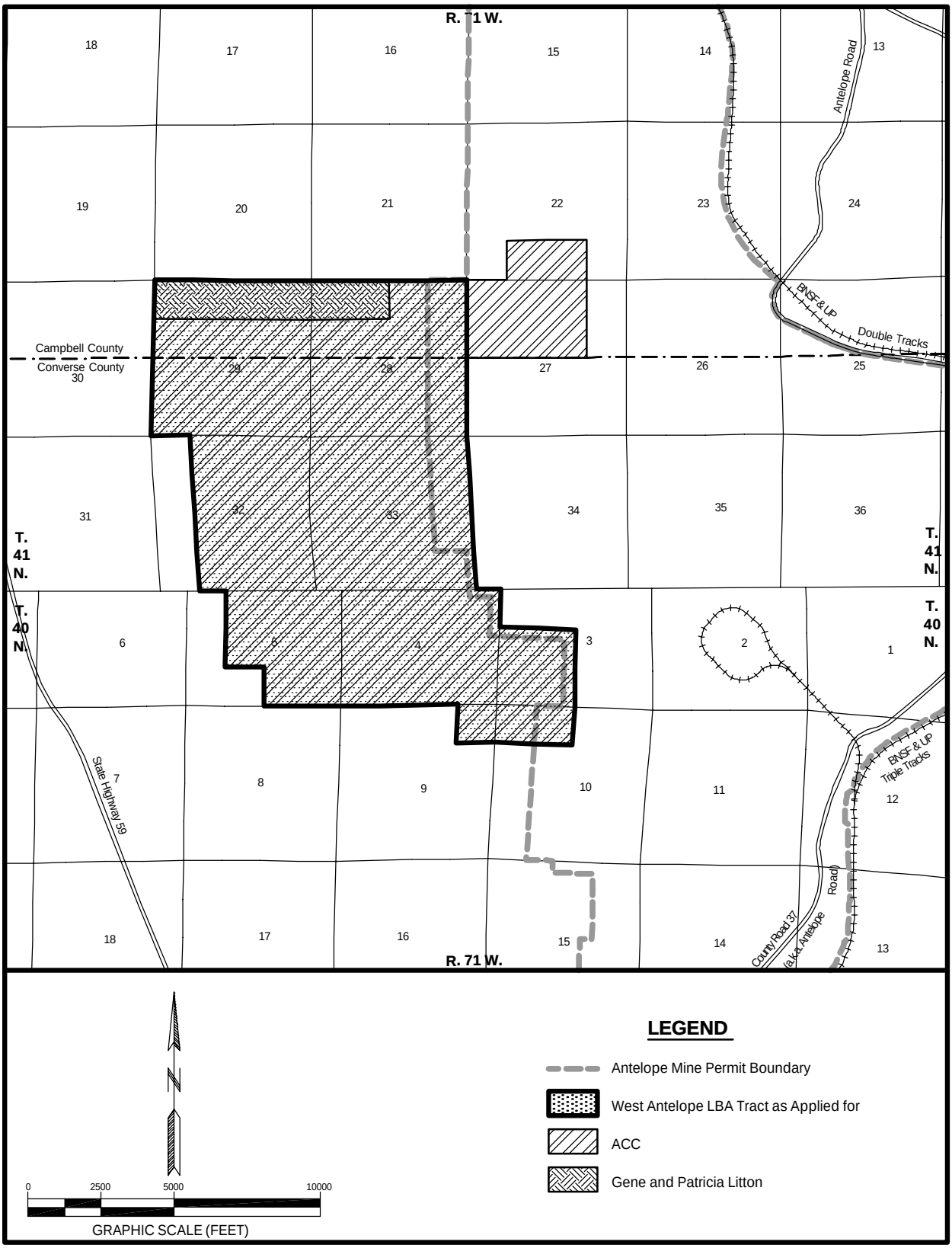

Figure 3-14. Surface Ownership Within the West Antelope LBA Tract.

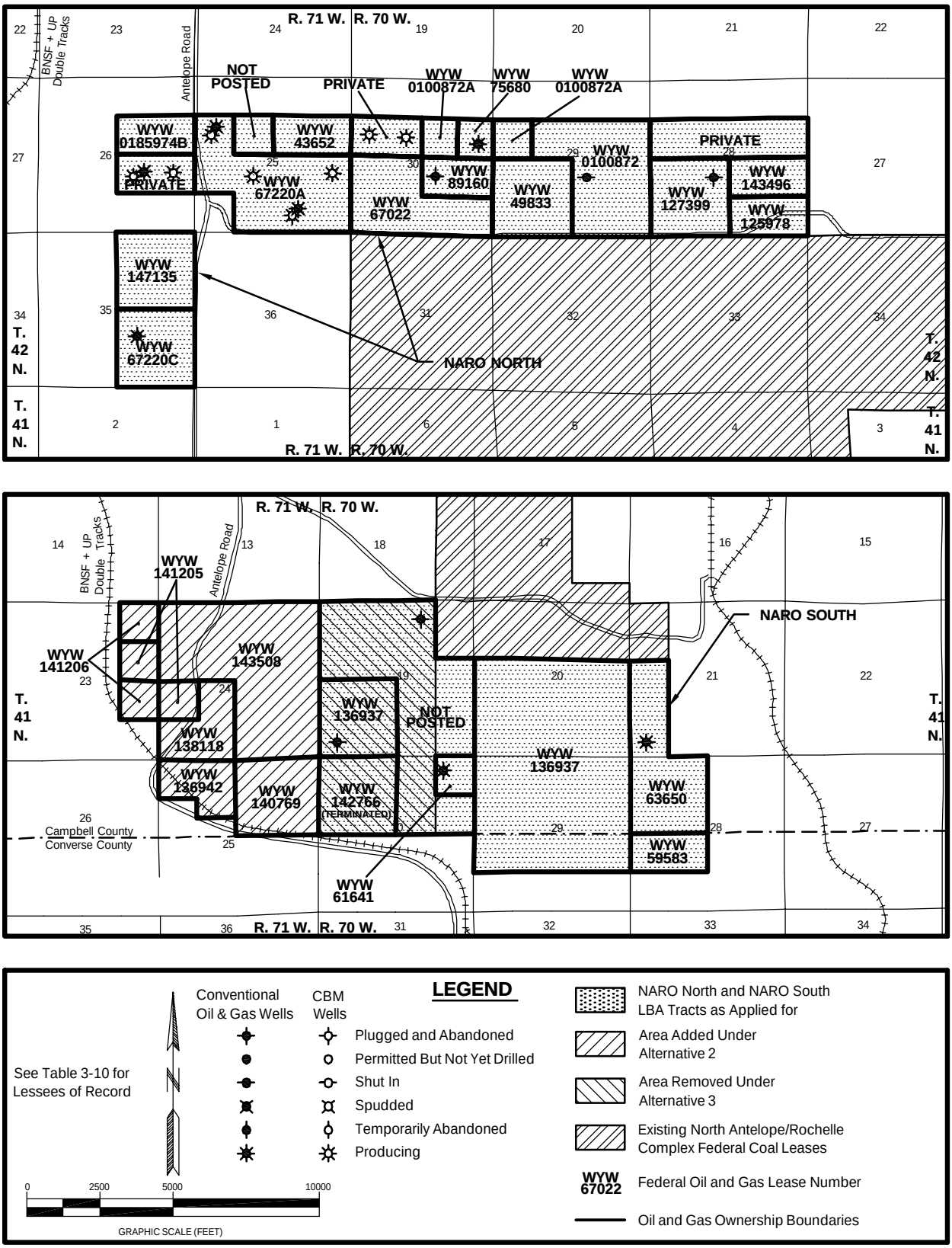

Figure 3-15. Oil and Gas Ownership on the NARO North and NARO South LBA Tracts.

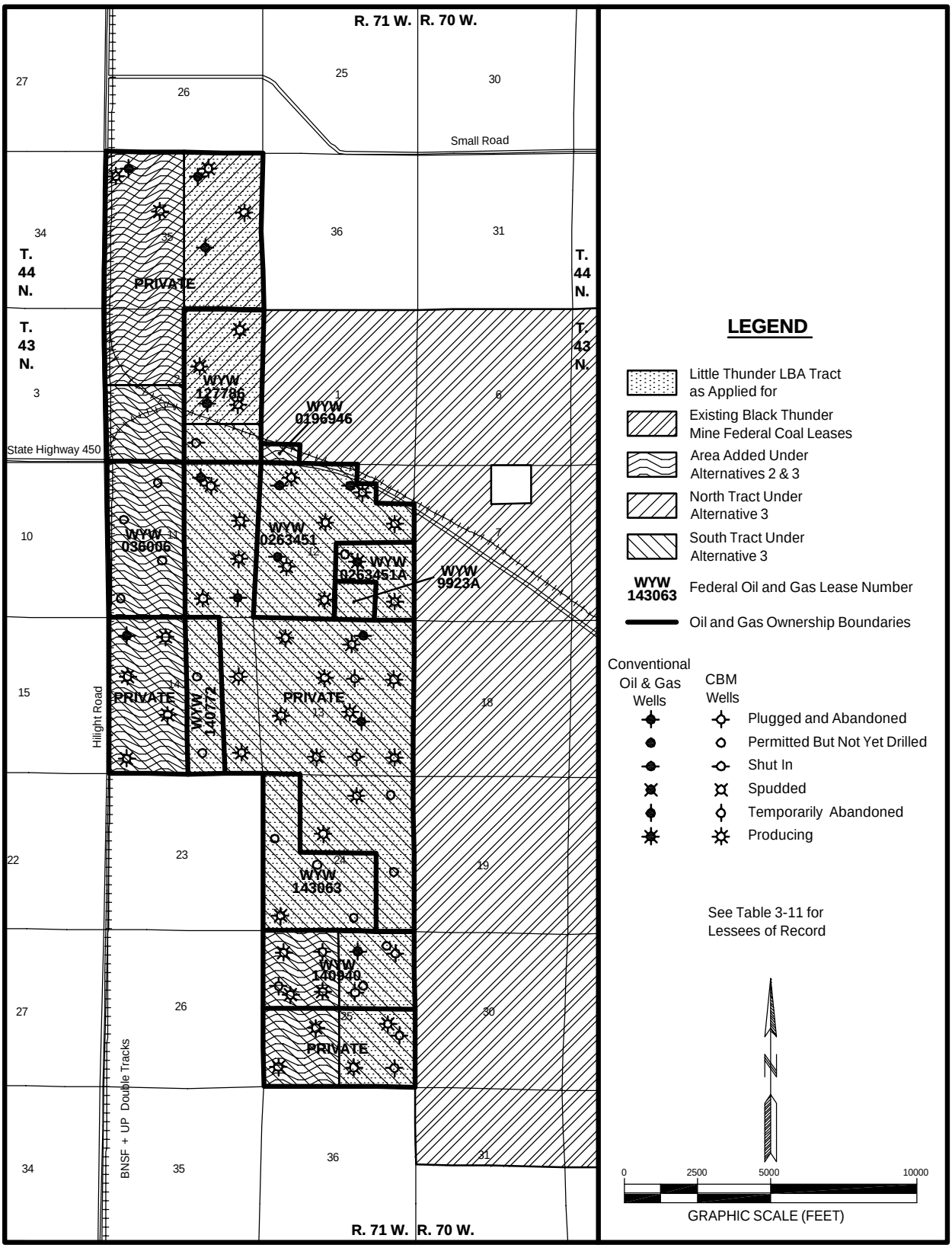

Figure 3-16. Oil and Gas Ownership on the Little Thunder LBA Tract.

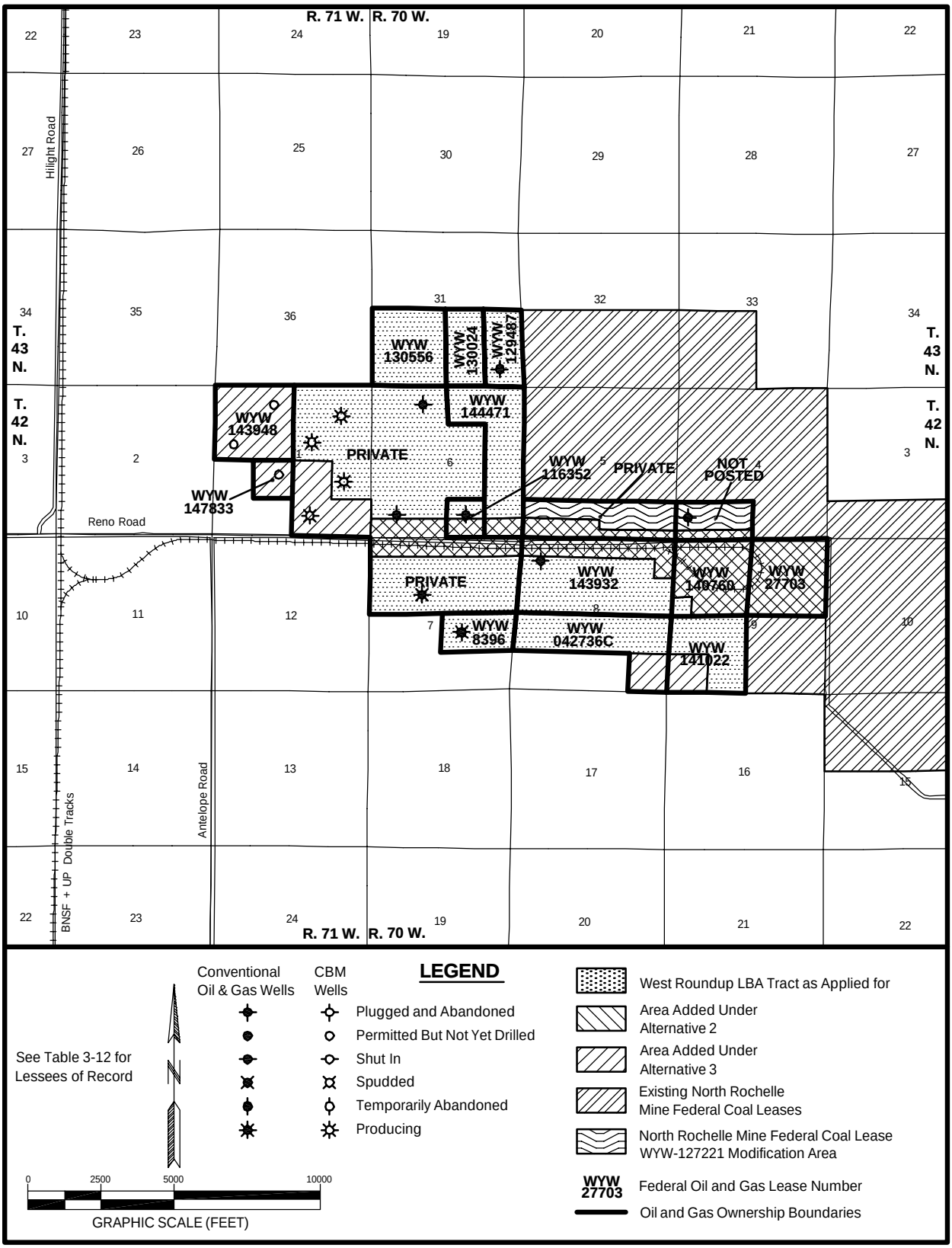

Figure 3-17. Oil and Gas Ownership on the West Roundup LBA Tract.

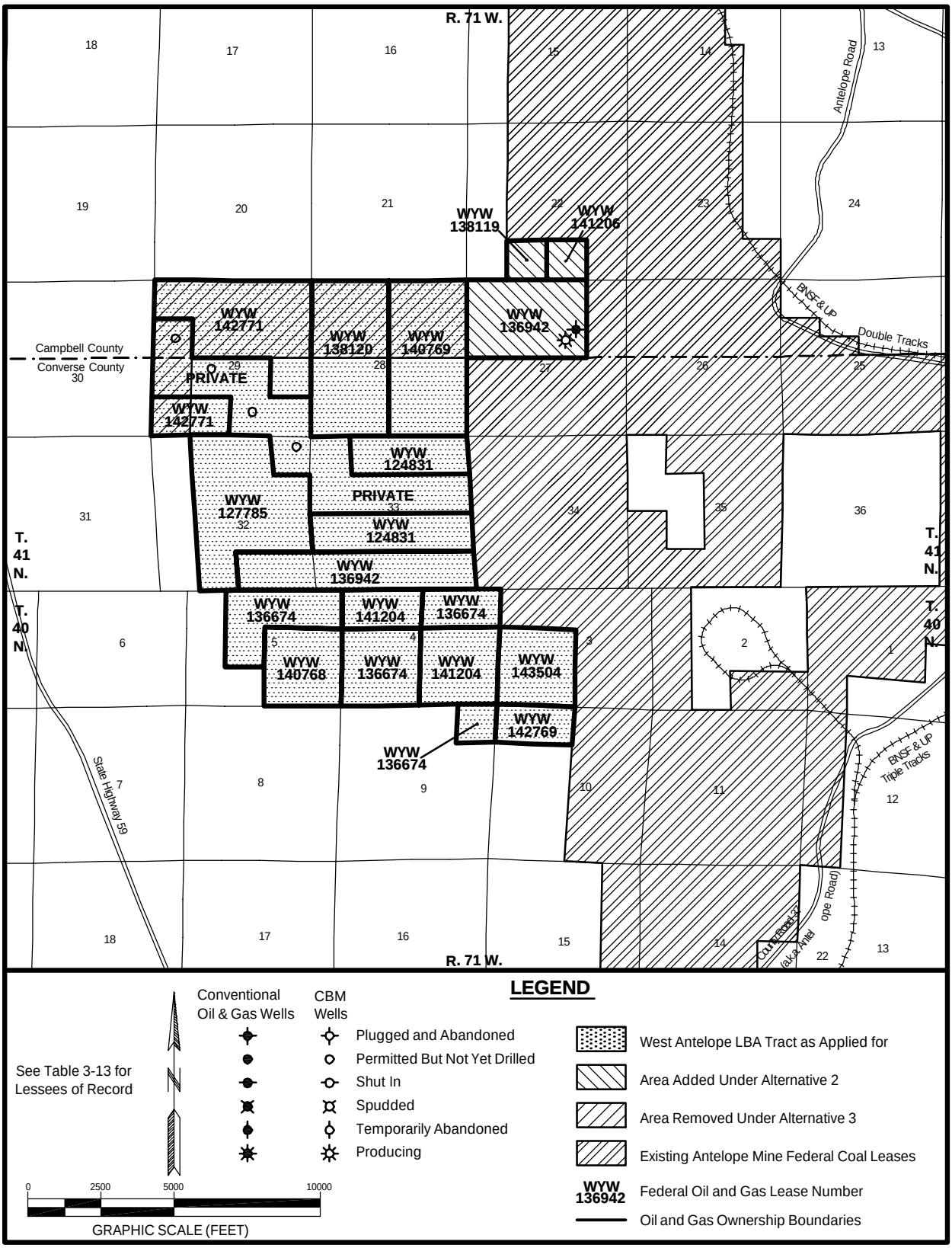

Figure 3-18. Oil and Gas Ownership on the West Antelope LBA Tract.

Table 3-10. NARO North and South LBA Tracts Oil and Gas Ownership.

For the following locations, both the oil and gas rights (including CBM) and coal rights are owned by the federal government.

Location	Lease Number	Lessees of Record
T.42N., R.70W.		
Section 28 Lots 9,10	WYW 143496	Powder River Coal Co.
Section 28 Lots 11-14	WYW 127399	Powder River Coal Co.
Section 28 Lots 15, 16	WYW 125978	Expired 12/31/2001
Section 29 Lots 11-14	WYW 049833	Powder River Coal Co. Key Production Co. Inc.
Section 29 Lots 6-10, 15,16	WYW 0 100872	Powder River Coal Co.
Section 29 Lot 5 Section 30 Lot 11	WYW 0 100872 A	Damson Oil Corp. Powder River Coal Co. IL Stalls R. Lee Tucker
Section 30 Lot 12	WYW 075680	Powder River Coal Co.
Section 30 Lots 13,14	WYW 089160	Powder River Coal Co.
Section 30 Lots 15-20	WYW 067022	Maurice W. Brown
T.42N., R.71W.		
Section 25 Lots 5, 9-15	WYW 067220 A	Powder River Coal Co.
Section 25 Lot 6		Not Posted
Section 25 Lots 7, 8	WYW 043652	NPC Inc. Powder River Coal Co. Citadel Energy Inc Key Production Co. Inc
Section 26 Lots 7, 8	WYW 0 185974 B	Powder River Coal Co. Ocean Energy Inc. Reunion Energy Co.
Section 35 Lots 9, 10, 15, 16	WYW 067220 C	Axel Johnson Expl. Black Hills Expl. & Prod. Co. D.L. Cook Jerry D. Ladd Meyer Oil Co. Inc Whiting Petro. Corp Dale O Wright
Section 35 Lots 1, 2, 7, 8	WYW 147135	Bill Barrett Corp.

Table 3-10. NARO North and South LBA Tracts Oil and Gas Ownership (Continued).

For the following locations, both the oil and gas rights (including CBM) and coal rights are owned by the federal government.

Location	Lease Number	Lessees of Record
T.41N., R.70W.		
Section 19 Lots 6-11, 13, 14, 19, 20		Not Posted
Section 19 Lots 15-18 Section 20 Lots 5-16 Section 29 Lots 1-12	WYW 136937	Powder River Coal Co.
Section 21 Lots 5, 12, 13 Section 28 Lots 3-6	WYW 063650	Citation 1998 Investment LP
Section 28 Lot 11, NESW	WYW 059583	DNR Oil & Gas Inc. GPM Inc. Jetta Production Co. Inc. JPC LLC Providence Energy Corp. Powder River Coal Co.
Section 30 Lot 5	WYW 061641	DNR Oil & Gas Inc.
Section 30 Lots 6, 11, 12		Not Posted
Section 30 Lots 7-10	WYW142766	Terminated
T.41N., R.71W.		
Section 23 Lots 1,9	WYW 141206	Williams Prod. RMT Co.
Section 23 Lot 8 Section 24 Lot 12	WYW 141205	Williams Prod. RMT Co.
Section 24 Lots 1-10, 15, 16	WYW 143508	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
Section 24 Lots 11, 13, 14	WYW 138118	Redstone Resources Inc. Yates Petroleum Corp
Section 25 Lots 1-4	WYW 140769	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co.
Section 25 Lots 9, 10, 12	WYW 136942	Gregor Klurfeld

Note: For the rest of the LBA tract, the oil and gas rights (including CBM) are privately owned, and the coal rights are federally owned.

Table 3-11. Little Thunder LBA Tract Oil and Gas Ownership.

For the following locations, both the oil and gas rights (including CBM) and coal rights are owned by the federal government.

Location	Lease Number	Lessees of Record
T.43N., R.71W.		
Section 1 Lot 16	WYW 0 196946	Chisholm Trail Ventures LP M&K Oil Co. Inc Questar Expl. & Prod. Co.
Section 2 Lots 5, 6, 11-14, 19, 20	WYW 127786	John P. Caviuolo
Section 11 Lots 3-6, 11-14	WYW 036006	G F Collins Jr Trust NPC Inc. Chisholm Trail Ventures LP Robert W. Deputy Thomas H. Farley Jr Kerr McGee Corp Key Production Co. Inc Questar Expl. & Prod. Co R B C Expl. Co Ryder Stilwell Oil Diana L. Stadelman Joseph R. Stadelman WP Properties Corp
Section 12 Lots 2-8, 11-14	WYW 0 263451	M&K Oil Co Inc
Section 12 Lot 15	WYW 009923 A	Chisholm Trail Ventures LP Key Production Co. In M&K Oil Co. Inc Questar Expl. & Prod. Co.
Section 12 Lots 9,10,16	WYW 0 263451 A	M&K Oil Co. Inc.
Section 14 Lots 2, 6, 9, 14	WYW 140772	Western Gas Resources Inc.
Section 24 Lots 4, 5, 10-15	WYW 143063	CH4 Energy LLC Western Gas Resources Inc Williams Prod. RMT Co.
Section 25 Lots 1- 8	WYW 140940	Western Gas Resources Inc.

Note: For the rest of the LBA tract, the oil and gas rights (including CBM) are privately owned, and the coal rights are federally owned.

Table 3-12. West Roundup LBA Tract Oil and Gas Ownership.

For the following locations, both the oil and gas rights (including CBM) are owned by the federal government

Location	Lease Number	Lessees of Record
T.42N., R.70W.		
Section 4 Lots 17,18		Not Posted
Section 6 Lots 8, 9, 15, 16, 23	WYW 144471	Lance Oil & Gas Co., Inc. Williams Prod. RMT Co.
Section 6 Lot 22	WYW 116352	Expired
Section 7 Lots 13, 14	WYW 008396	Myco Industries Inc. Sacramento Partners LP
Section 8 Lots 1-8	WYW 143932	Williams Prod. RMT Co. Lance Oil & Gas Co., Inc.
Section 8 Lots 9-12, 16	WYW 042736 C	Bill Barrett Corp.
Section 9 Lots 3-6	WYW 140760	Abo. Petr. Corp. Myco Industries Inc. Yates Drilling Co. Yates Petroleum Co.
Section 9 Lots 11-14	WYW 141022	Julian C. Tucker
Section 9 Lots 1, 2, 7, 8	WYW 027703	Clayton Conrad Bill Barrett Corp. George P. Jouflas
T.43N., R.70W.		
Section 31 Lots 13, 20	WYW 129487	Westport Oil & Gas Co, Inc.
Section 31 Lots 14, 19	WYW 130024	Westport Oil & Gas Co, Inc.
Section 31 Lots 15-18	WYW 130556	Westport Oil & Gas Co. Inc
T.42N., R.71W.		
Section 1 Lots 7-10	WYW 143940	Lance Oil & Gas Co. Inc Williams Prod. RMT Co.
Section 1 Lot 15	WYW 147833	Lance Oil & Gas Co. Inc Williams Prod. RMT Co.

Note: For the rest of the LBA Tract, the oil and gas rights (including CBM) are privately owned and the coal rights are federally owned.

Table 3-13. West Antelope LBA Tract Oil and Gas Ownership.

For the following locations, both the oil and gas rights (including CBM) and coal rights are owned by the federal government.

Location	Lease Number	Lessees of Record
T.40N., R.71W.		
Section 3 Lots 15-18	WYW 143504	Abo Petroleum Corp. Myco Industries Inc. Yates Drilling Co. Yates Petroleum Co.
Section 4 Lots 7-10, 13, 14, 19, 20	WYW 141204	Swift Energy Co.
Section 4 Lots 5, 6, 11, 12, 15-18 Section 5 Lots 5-7, 10-12, 15 Section 9 Lot 1	WYW 136674	Swift Energy Co.
Section 5 Lots 13, 14, 19, 20	WYW 140768	Swift Energy Co.
Section 10 Lots 3, 4	WYW 142769	M.J. Harvey Jr.
T.41N., R.71W.		
Section 22 Lot 2	WYW 141206	Williams Prod. RMT Co.
Section 22 Lot 16	WYW 138119	Bowers Oil & Gas Inc. Spring Creek Ranch
Section 27 Lots 6-11 Section 32 Lots 15, 16 Section 33 Lots 13-16	WYW 136942	Gregor Klurfeld
Section 28 Lots 1, 2, 7-10, 15, 16	WYW 140769	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co
Section 28 Lots 3-6, 11-14	WYW 138120	Bowers Oil & Gas Inc. Spring Creek Ranch
Section 29 Lots 1-4, 6-9, 13, 14	WYW 142771	Lance Oil & Gas Co. Inc. Williams Prod. RMT Co
Section 32 Lots 2, 3, 6-11, 14	WYW 127785	Fred L. Engle
Section 33 Lots 1-3, 9-12	WYW 124831	Abo Petroleum Co. Key Production Co. Myco Industries Yates Drilling Co Yates Petroleum Co.

Note: For the rest of the LBA Tract, the oil and gas rights (including CBM) are privately owned and the coal rights are federally owned.

Forty-two CBM wells are currently producing and three are shut-in within the lands encompassed by the Little Thunder LBA Tract as proposed and the lands added under BLM's alternatives. The WOGCC has approved a well spacing pattern of one well per 80 acres for development of CBM resources in the PRB. Most of the available 80-acre spacing units within the Little Thunder LBA Tract and the lands added under the Action Alternatives have been drilled and are producing (Figure 3-16). WOGCC records from September 17, 2003 indicates that the reported cumulative production from each of these wells through July 2003 ranged from approximately 6,000 MCF to 315,000 MCF gas. Drilling in the West Roundup and NARO North LBA Tracts to date has only occurred in the western portion of these tracts, and the wells are shown as producing (Figures 3-15 and 3-17). Due to the limited production history, estimates of well life, reserves, or economics cannot be reliably forecasted in most cases. Provisional production decline curves prepared for some of the wells with the lengthiest production histories suggest that the expected life for wells located on or near the SPRB LBA tracts might range from one to five years. These wells demonstrate that CBM can be produced in areas that have been affected by mining-related groundwater drawdown.

Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas, and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market. Currently, some of these oil and gas production facilities, particularly oil and gas pipelines, exist on the LBA tracts, as discussed in Section 3.17 of this EIS. Additional support facilities will continue to be constructed on the LBA tracts as new conventional oil and gas and CBM wells are drilled and completed.

Coal mining is a dominant land use within the General Analysis Area. The North Antelope/Rochelle Complex, Black Thunder, North Rochelle, Antelope, and Jacobs Ranch Mines form a group of contiguous or nearly contiguous active surface coal mines located in southern Campbell and northern Converse Counties (Figure 3-1). Coal production at these five mines increased by 217 percent between 1990 and 2002 (from approximately 70 million tons in 1990 to over 222 million tons in 2002). Since 1992, nine maintenance coal leases have been sold within this group and the five LBA tracts being evaluated in this EIS are in this group of mines (Tables 1-1 and 1-2).

Neither Campbell nor Converse Counties have applicable countywide land use plans, nor do the proposed lease areas have designated zoning classifications. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county. The *Converse County Land Use Plan* (Converse County 1978) does not specifically address coal leasing.

Big game hunting is the principal recreational land use within the General Analysis Area, and pronghorn, mule deer, white-tailed deer, and elk are present within the area. On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past two decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 1996).

In general, publicly owned lands are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are often closed to the public, further limiting recreational use. There are public surface lands included within the NARO North LBA Tract, the Little Thunder LBA Tract, and the West Roundup LBA Tract. There are no public surface lands included in the NARO South or West Antelope LBA Tracts. (Figures 3-11 through 3-14)

Specific details regarding big game herd management objectives within and near the General Analysis Area are contained in the *Casper* and *Sheridan Region Annual Big Game Herd Unit Reports* (WGFD 2000, 2002). The WGFD classifies the entire General Analysis Area as yearlong and winter/yearlong habitat for antelope. The extreme southern portion of the General Analysis Area is within severe winter range for antelope. All of the LBA tract configurations are classified as yearlong and/or winter/yearlong antelope habitat. No crucial or critical pronghorn habitat is recognized by the WGFD in this area. The proposed lease areas are within pronghorn antelope Hunt Areas 24 and 27, which contain the Hilight and Cheyenne River Herd Units, respectively. In post-season 2002, the population of the Hilight Herd Unit was estimated to be approximately 11,000 animals, which is at the WGFD objective of 11,000. The post-season 2002 population of the Cheyenne River Herd Unit was estimated to be approximately 34,146 animals with a population objective of 38,000 antelope (WFGD 2002).

Historical problems associated with the management of the Hilight Herd Unit include hunter access, over harvest on limited public lands, and quantifying landowner preferences and desires. Prior to 1997, the herd population was fairly stable and near the objective of 11,000 antelope. Losses from severe winters, poor production rates, and disease subsequently decreased the population, but it has recently recovered and begun to stabilize near the objective level. Hunt Area 24 contains mostly privately owned surface lands with poor hunter access to limited publically owned lands; therefore, the number of antelope will steadily increase. As the population exceeds objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners.

A series of harsh winter conditions and correspondingly poor reproduction rates are believed to be the main reasons that population of the Cheyenne River Herd Unit is under objective. In an effort to increase the population of this herd, the WGFD will decrease the availability of hunting licenses in areas where winters have been particularly hard and where the antelope population has been low for several years. Management direction will be to decrease female harvest slightly to compensate for severe winters.

The WGFD has classified the entire General Analysis Area as either out of the normal mule deer use range or yearlong range, with some winter/yearlong range in the extreme southern portion of the area. Crucial or critical mule deer habitat does not occur within the General Analysis Area. The proposed lease areas are located within mule deer Hunt Areas 10 and 21, part of the Thunder Basin Mule Deer Herd Unit, which also includes Hunt Areas 7, 8, 9, and 11. The Thunder Basin Herd Unit encompasses 3,642 square miles, of this, 71 percent is privately owned. Access fees are common, resulting in heavy hunting pressure on accessible public lands, particularly in recent years. Between 1983 and 2001, the post-season objective for this mule deer herd was 13,000, but the population was consistently above that objective. The 2000 post-season population was estimated at 21,742, which was 67 percent above the objective. To address this concern, WGFD increased the objective to 20,000 head in December 2001. Forage production in 2000 was below normal due to drought conditions, and a severe winter in 2000-2001 resulted in increased mortality and poor production. Consequently, the 2001 post-season herd population dropped to about 18,000. Drought conditions continued more significantly through 2002, but a mild 2001-2002 winter moderated the negative drought effects. In conjunction with a reduced harvest in 2002, the post-season population was being maintained at roughly 18,000 animals, 10 percent below the objective. It is likely that drought

conditions will continue to suppress productivity and the Thunder Basin Mule Deer Herd Unit population will remain stable or decrease slightly in 2003.

The Rochelle Hills Elk Herd resides in the Rochelle Hills that border the eastern edge of the General Analysis Area. The LBA tracts within the General Analysis Area are within Elk Hunt Areas 113 and 123; however, very limited use of these lands by elk occurs. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. As more lands are reclaimed from coal mining adjacent to the Rochelle Hills, elk are shifting their winter use to those sites. Such lands typically offer excellent winter grass supplies, especially during more severe winters when other sites are less accessible. Presently, elk are regularly using the reclaimed mined lands of the Jacobs Ranch, Black Thunder, and North Rochelle Mines. More such habitat should become available over the next several years. Much of the occupied range of this herd is located on the TBNG, which is administered by the USDA-FS. While hunting in Areas 113 and 123 has been permitted every two or three years, Area 126, which is south of the General Analysis Area, has had an annual hunting season. Bull quality is very good for this herd, and many taken have scored in the record books. Owing to their habituation to humans, many people enjoy these elk along Highway 450 and within accessible USDA-FS land; thus, they provide nonconsumptive recreational use opportunities. These elk are not causing significant damage to private lands and most area landowners as well as hunters generally desire a high quality herd. Elk have been observed dispersing from the designated herd boundary, possibly due to increasing population density and habitat limitations.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer are seldom observed within the General Analysis Area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire General Analysis Area, with the exception of a narrow corridor along Antelope Creek, as out of normal white-tailed deer use range. The narrow corridor along Antelope Creek is classified as yearlong range.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the General Analysis Area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. There are no fisheries on any of the LBA tracts. Little Thunder Creek supports channel catfish and a variety of nongame fish downstream of the Little Thunder LBA Tract. Little Thunder Reservoir, which is located on Little Thunder Creek upstream of the Little Thunder LBA Tract in Section 22, T.43N., R.71W., has historically maintained and currently

maintains both game and non-game fisheries.

3.12 Cultural Resources

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the General Analysis Area, appears to have been inhabited by aboriginal hunting and gathering people for more than 11,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

The general chronology for aboriginal occupation (dated as years before present [B.P.]) is:

- Paleoindian period (11,000-7,500 years B.P.)
- Archaic period (7,500-1,800 years B.P.)
- Prehistoric period (1,800-400 years B.P.)
- Historic period (200-120 years B.P.)

The Paleoindian period includes a series of cultural complexes identified by distinctive large projectile points (spear points) often associated with the remains of large, now extinct mammals (mammoth, bison, camel, etc.). The Archaic period is characterized by a range of smaller side-notched, stemmed or corner-notched projectile points and by more generalized subsistence pursuits including the gathering of plant resources. This lifeway continued to the late Prehistoric period, which is marked by a technological change from dart projectiles to the bow and arrow and by the appearance of ceramics. During the Archaic and late Prehistoric periods, the PRB was occupied by small bands of hunters and gatherers whose movements were determined to a large degree by seasonal and environmental changes that influenced the occurrence of subsistence resources (BLM 1979).

Protohistoric and early Historic sites are found in the PRB, including the General Analysis Area. This period is characterized by rare historic trade goods, sites, and routes associated with early trappers and military expeditions, and early ranching attempts that date to the 1880s. A few small coal mining sites also exist.

Historic sites within the General Analysis Area have been recorded as debris scatters representing sheepherder camps and related activities. No historic trails are known or have been recorded within the General Analysis Area, although the Bozeman Trail crosses the southwestern portion of the PRB.

A Class III cultural resources survey is a professionally conducted, intensive and comprehensive inventory of a target area, designed to locate all cultural properties which have surface and exposed profile indications. The goal of the survey is to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area. Cultural

properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion in the NRHP. That determination is made by the managing federal agency in consultation with SHPO. Consultation with SHPO must be completed prior to approval of the MLA mining plan.

Once a Class III survey is completed, site-specific testing or limited excavation is utilized, if necessary, to gather additional data which will: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that will be conducted during implementation of a treatment plan if the site is eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigative measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Data recovery plans are required for those sites recommended as eligible for the NRHP following testing and consultation with SHPO. Until consultation has occurred and agreement regarding NRHP eligibility has been reached, all sites recommended as eligible or undetermined eligibility must be protected from disturbance. Full consultation with SHPO will be completed prior to approval of the MLA mining plans. Those sites determined to be unevaluated or eligible for the NRHP through consultation would received further protection or treatment.

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil field development and surface mining operations have been conducted in the General Analysis Area. PRCC, TBCC, TCC, and ACC all contracted with GCM Services, Inc. of Butte, Montana to perform Class III and Class I surveys of their respective LBA study areas in 1999 and 2001. Each of the LBA study areas is comprised of the LBA tract as applied for, BLM's proposed alternative tract configurations, and the applicant mine's anticipated permit amendment study area. These areas include all anticipated areas of disturbance assuming the coal is mined by the existing adjacent mines.

The NARO North and South LBA study area has been entirely surveyed for cultural resources at a Class III level. A total of 194 cultural sites were documented in the study area, of which 79 sites are located within the NARO North and NARO South LBA Tracts and quarter mile disturbance buffers. These sites are classified as prehistoric (59 sites), historic (17 sites), multi-component (one site), or undetermined (two sites). Four prehistoric sites have been recommended as eligible for the NRHP by the cultural site recorder.

The Little Thunder LBA study area has been entirely surveyed for cultural resources at a Class III level. A total of 44 archaeological sites and 16 isolated finds have been documented in the Little Thunder LBA study area. These sites are classified as prehistoric (25 sites), historic (11 sites), or multi-component (eight sites). All of these sites are listed as not eligible for the NRHP by SHPO or were recommended as not eligible by the cultural site recorder. No further work with cultural resources has been recommended in this study area.

The entire West Roundup LBA study area has been surveyed for cultural resources at a Class III level. A total of 31 archaeological sites have been recorded and documented in the West Roundup LBA study area. These sites are classified as prehistoric (14 sites), historic (11 sites), or multi-component (six sites). One historic and 17 prehistoric isolated finds were also recorded. None of the sites have been recommended by the cultural site recorders or determined by an agency to be eligible for the NRHP, and no further work is recommended.

The West Antelope LBA study area has been entirely surveyed for cultural resources at a Class III level. From these cultural inventories, 53 archaeological sites have been recorded and documented in the West Antelope LBA study area. These sites are classified as prehistoric (42 sites), historic (10 sites), or multi-component (one site). One historic and 12 prehistoric isolated finds were also recorded. Three prehistoric campsites, as well as one site containing prehistoric stone rings, are recommended as eligible for the NRHP by their cultural site recorder. An additional four eligible sites, which are within or adjacent to the existing Antelope Mine's permit area, were previously recorded and have been mitigated to prevent adverse effects to the site's cultural resources.

3.13 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded to date within the General Analysis Area. However, the geographic position of the General Analysis Area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone,

Arapaho, Oglala Lakota, Rosebud Sioux, Flandreau Santee Sioux, Santee Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, and Cheyenne River Sioux. These tribal governments and representatives have been sent copies of the EIS. They are also being provided with maps showing the location of each of the LBA tracts and more specific information about the known cultural sites on each of the tracts in this analysis. Their help is being requested in identifying potentially significant religious or cultural sites in the General Analysis Area before a leasing decision is made on each of the LBA tracts.

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update the BLM *Buffalo Resource Area RMP*. Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.14 Paleontological Resources

The formations exposed on the surface of the PRB are the sedimentary Eocene Wasatch and Paleocene Fort Union Formations, which are both known to contain fossil remains. Some intensive paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds; eggs; amphibians; fish; plants; and non-marine invertebrates such as mollusks and ostrocods. The Fort Union Formation also contains fossils of plants, reptiles, fish, amphibians, and mammals.

USDA-FS has developed a draft classification system which they have used in the revised *Land and Resource Management Plan for the Thunder Basin National Grassland* (USDA-FS 2001b) to classify geological units according to the probability of them yielding paleontological resources that are of concern to land managers. The classification is based largely on how likely a geologic unit is to produce scientifically significant fossils. The fossil yield potential classes are described below.

Class 1 - Igneous and metamorphic (volcanic ashes are excluded from this category) geologic units that are not likely to contain recognizable fossil remains.

Class 2 - Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

Class 3 - Fossilferous sedimentary geologic units whose fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.

Class 4 - Class 4 geologic units are Class 5 units (see below) that have

lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.

Class 5 - Fossilferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant nonvertebrate (plant and invertebrate) fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

USDA-FS has determined that the USDA-FS lands included in the NARO North, Little Thunder, and West Roundup LBA Tracts are classified as Class 3 or Class 5.

Paleontological resource examinations associated with surface mining operations have been conducted in conjunction with cultural resource inventories within the General Analysis Area. The inventories include pedestrian examinations for fossils along rock outcrops. A primary goal of the paleontological surveys that have been conducted is to locate concentrations of fossilized vertebrate skeletal material and evidence (trace fossils) such as those reported to occur in the Wasatch Formation within the PRB. If unique finds are located, qualified paleontologists are then assigned to assess and mitigate the site.

The lack of well-exposed rock outcrops contributes to the lack of vertebrate fossils, as does the low preservation potential and conditions of deposition of the Wasatch and Fort Union Formations. In contrast to the lack of fossil animal material, fossil plant material is common. The fossil plants inventoried are primarily leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. The fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

No significant or unique paleontological localities have been recorded on federal lands in the General Analysis Area.

3.15 Visual Resources

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the General Analysis Area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and coal mines. Existing surface mines form a nearly continuous band on the east side of Highway 59 from Gillette south about 50 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline ROWs, CBM well shelters, and CBM compressor stations),

transportation facilities (roads and railroads), and electrical power transmission lines. The natural scenic quality in the immediate lease area is fairly low because of the industrial nature of the adjacent existing mining operations.

Visual resource management guidelines for BLM lands are to manage public lands for current VRM classifications and guidelines. The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for an increasing level of change within the characteristic landscape.

BLM evaluated the visual resources on lands in the Buffalo and Platte River RMPs (BLM 1985a and 1985b) for management purposes. The inventoried lands were classified into VRM classes. In the General Analysis Area, which does not include any BLM-administered surface land, the predominant VRM class is IV. For lands classified as VRM Class IV, activities, such as mining, attract attention and are dominant features of the landscape in terms of scale.

The USDA-FS has established visual quality objectives for the TBNG. In the General Analysis Area, facilities and landscape modifications may be visible but should be reasonably mitigated to blend and harmonize with natural features according to the revised *Land and Resource Management Plan for the Thunder Basin National Grassland* (USDA-FS 2001b). The NARO North, Little Thunder, and West Roundup LBA Tracts include USDA-FS surface land.

Current mine facilities and activity are visible from various public-use roads in the General Analysis Area, including Antelope Road, Mackey Road, Piney Canyon Road, Edwards/Reno Road, Hilight Road, State Highway 59, State Highway 450, and County Road 37. Mining activity and facilities are also visible from the LBA tracts.

3.16 Noise

Existing noise sources in the General Analysis Area include coal mining activities, traffic on nearby state highways and county roads, rail traffic, wind, and CBM compressor stations. Noise originating from CBM development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. However, if the drilling and construction sites are sufficiently widespread, then the elevated levels of noise generated from each site should not overlap in time or space with noise from other sites. Long-term noise from the ongoing development of CBM resources is associated with the new compressor stations.

Studies of background noise levels at adjacent mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. Current noise levels in the proposed LBA tracts are estimated to be 40-60

dB(A), with the noise level increasing with proximity to active mining at adjacent mines. Mining activities are characterized by noise levels of 85-95 dB(A) at 50 ft from actual mining operations and activities (BLM 1992b). The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is dB(A). It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-19 presents noise levels associated with some commonly heard sounds.

The nearest occupied dwellings to the five LBA tracts included in this analysis are:

- one occupied dwelling is located at the west side and immediately adjacent to the southern edge of the NARO North LBA Tract;
- no occupied dwellings are closer than three miles from the NARO South LBA Tract;
- one occupied dwelling is located less than one mile from the western edge of the Little Thunder LBA Tract and the area added by Alternative 2;
- the Wilkinson homestead house is located just over three miles from the southern edge of the West Roundup LBA Tract, although it is property of PRCC and not occupied;
- one occupied dwelling is located approximately one mile from the western edge of the West Antelope LBA Tract.

Figures 3-20 through 3-23 depict the locations of these residences with respect to the LBA tracts.

3.17 Transportation Facilities

Within the General Analysis Area, the major north-south public transportation corridor is State Highway 59 in Campbell and Converse Counties, and the principal east-west transportation corridor is State Highway 450 in Campbell County. Other paved county roads, including the Edwards Road, Reno Road, and Antelope Road in Campbell County and County Road 37 in Converse County, provide public and private access within the General Analysis Area. There are numerous other improved and unimproved local roads and accesses in the area for both public and private use.

The General Analysis Area presently has one major railroad. The Gillette-Douglas rail spur, used jointly by BNSF & UP, runs north-south through the area with spur lines connecting the railroad with the applicant mines for transporting coal that originates in the General Analysis Area. The DM&E Railroad is presently proposing expansion into Wyoming. Although the specific route is still under consideration, the tracks would terminate at the coal mines located in the General Analysis Area.

There are numerous oil and gas pipelines, power lines, telephone lines, and ROWs in the General Analysis Area. Figures 3-20 through 3-23 depict the current

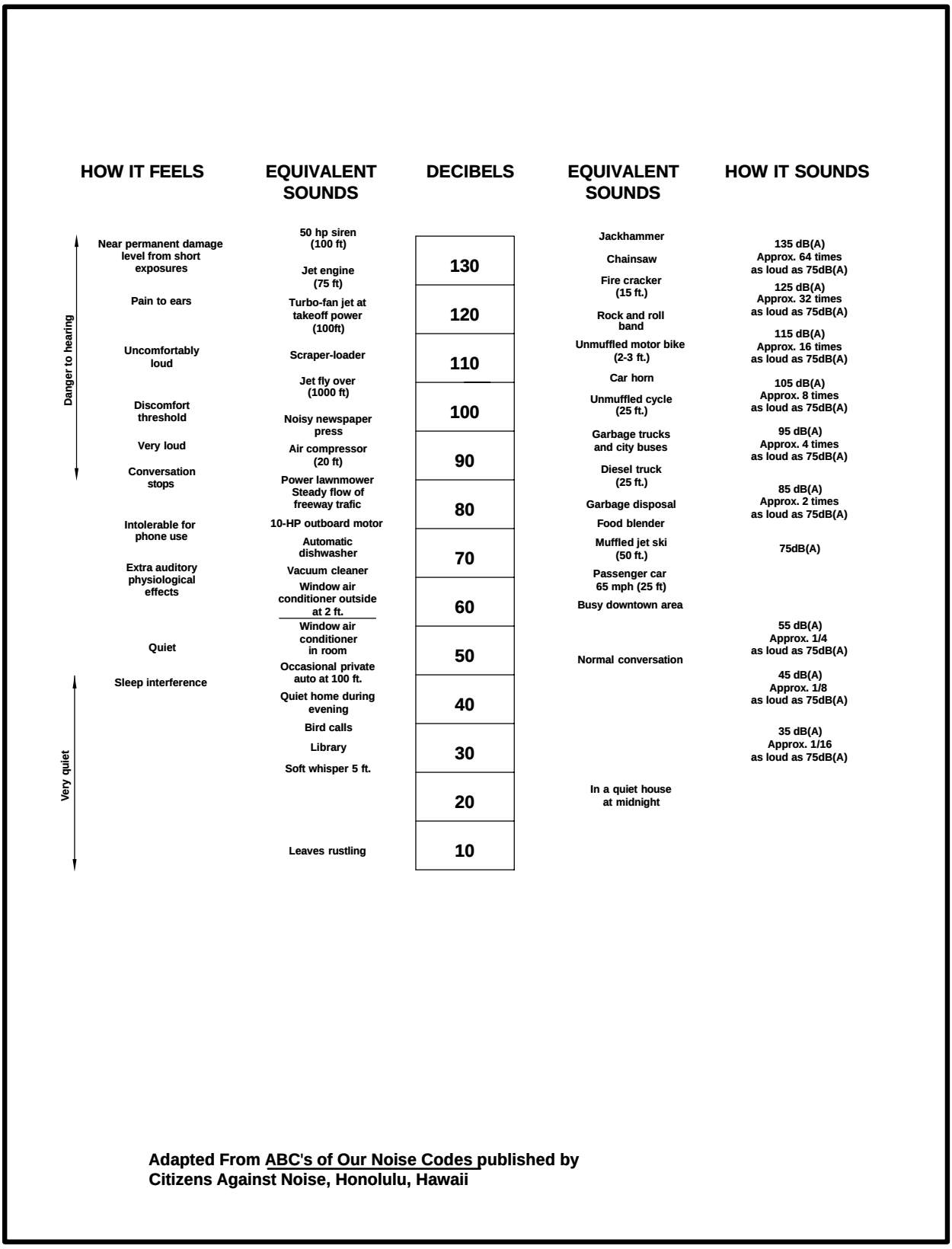

Figure 3-19. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

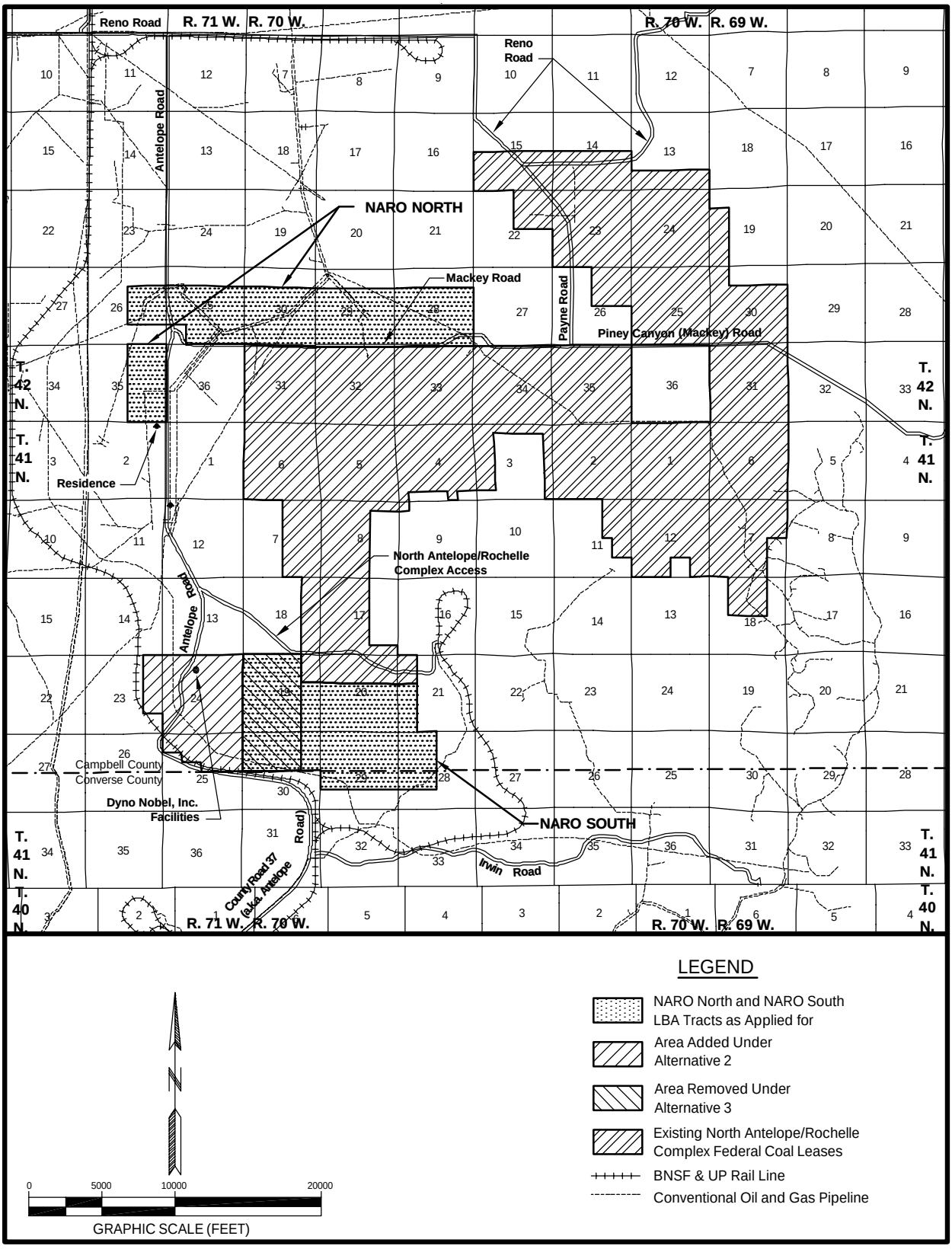

Figure 3-20. Transportation Facilities Within and Adjacent to the NARO North and NARO South LBA Tracts.

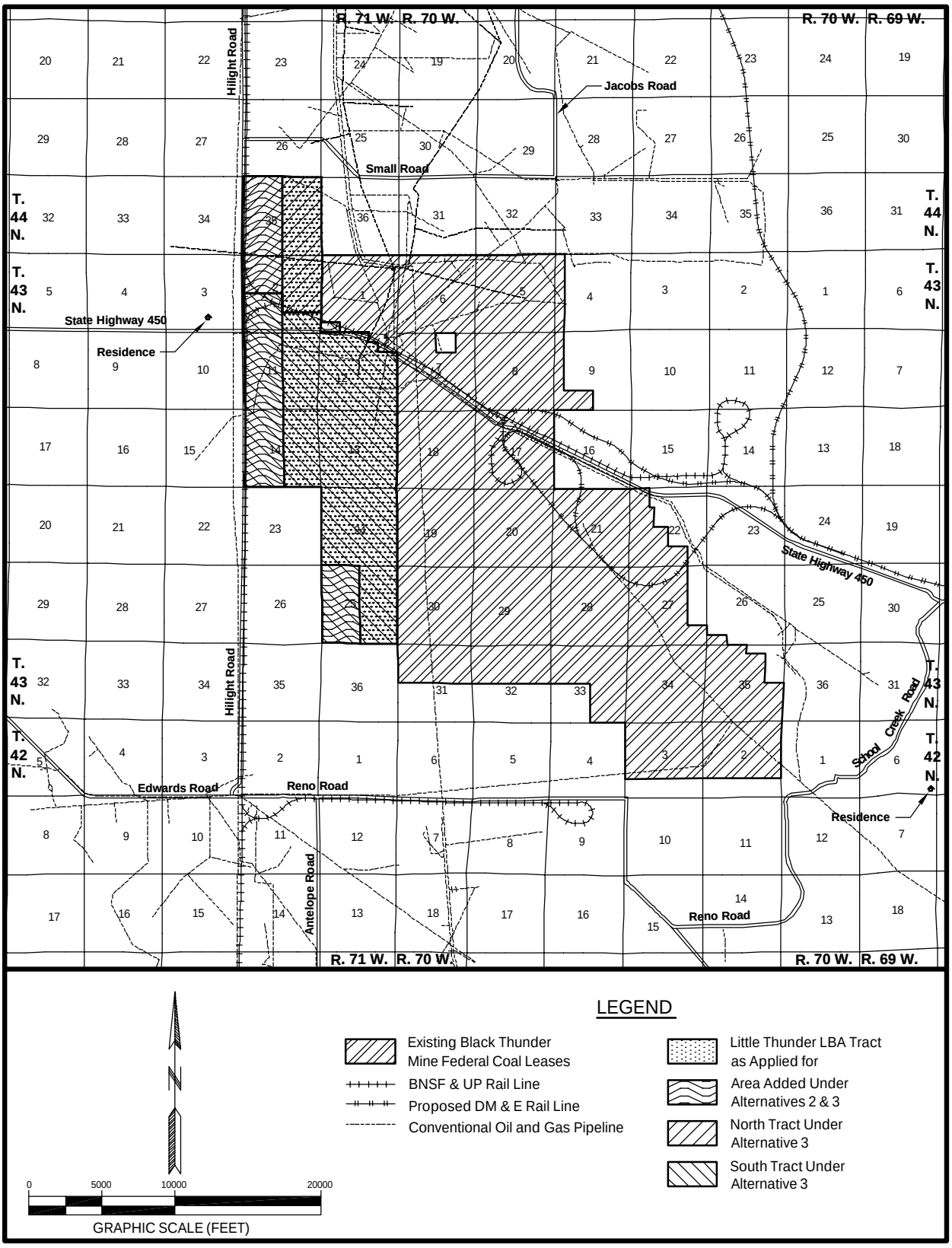

Figure 3-21. Transportation Facilities Within and Adjacent to the Little Thunder LBA Tract.

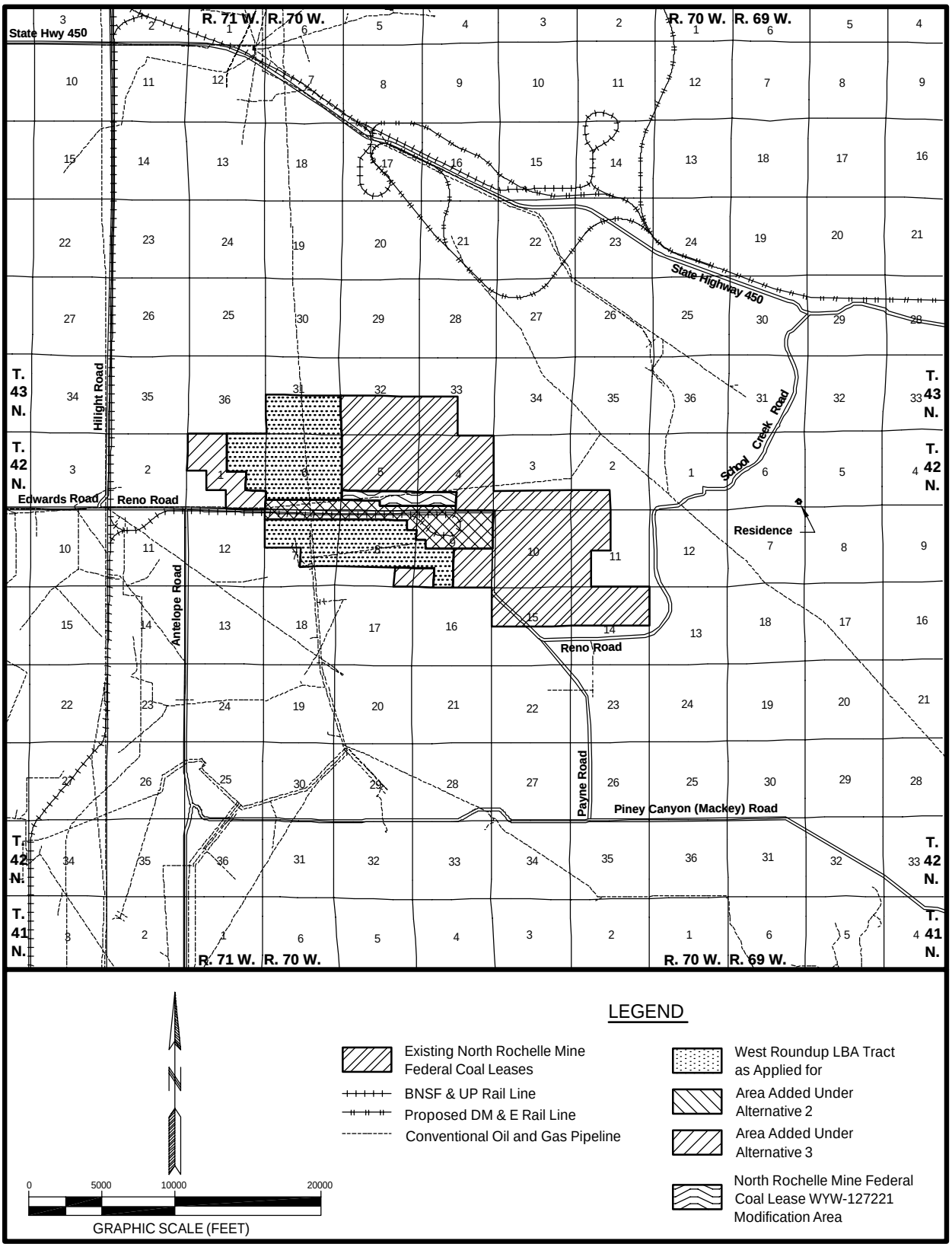

Figure 3-22. Transportation Facilities Within and Adjacent to the West Roundup LBA Tract.

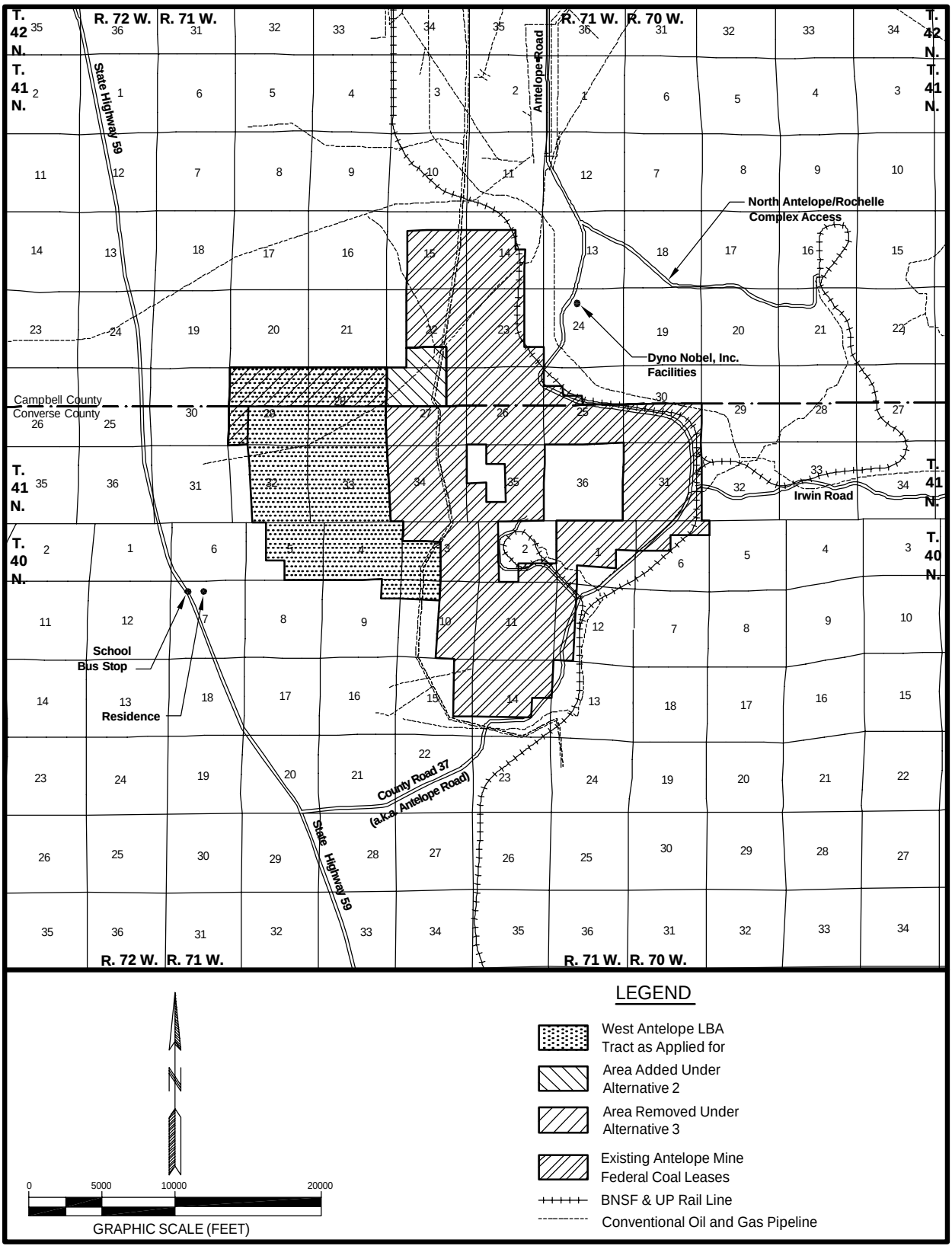

Figure 3-23. Transportation Facilities Within and Adjacent to the West Antelope LBA Tract.

transportation facilities in the LBA tracts included in this EIS.

3.18 Socioeconomics

The social and economic study area for the proposed project involves primarily Campbell County and the cities of Gillette and Wright; however, it also includes the city of Douglas in Converse County. The communities of Gillette and Douglas would most likely attract the majority of any new residents due to their current population levels and the availability of services and shopping amenities.

3.18.1 Population

According to 2000 census data, Campbell County had a population of 33,698, with Gillette accounting for 19,646 of the county's residents and Wright accounting for 1,347. Between 1990 and 2000, Gillette grew by 2,011 persons, averaging 1.1 percent per year. Wright had an average growth rate of 0.9 percent during this time period (U.S. Department of Commerce 1990 and 2000). The estimated July 2002 Campbell County population was 36,110, which represents a greater than three percent annual growth rate in recent years and makes Campbell County the fastest growing county in the state (Wyoming Department of Administration and Information 2003a).

Converse County's population in 2000 was 12,052, with 5,288 of the county's residents living in Douglas. Between 1990 and 2000, Douglas grew by 212 persons, an average increase of 0.4 percent per year. The July 2002 estimated population of Converse County was 12,433, indicating a recent annual growth rate of 1.4 percent since the April 2000 census.

CBM-spurred population growth is occurring in both Gillette and Douglas. The current CBM boom is contributing to low housing vacancy and a tight labor market. To date, however, enrollment in Gillette-area schools has not increased as a result of CBM development due to a mobile, relatively young work force (Mathes 2002).

3.18.2 Local Economy

Coal production, as reported by the Wyoming State Inspector of Mines, showed the State's coal mines set a new yearly production record of 373.2 million tons in 2002. This was an increase of 1.2 percent over the 368.9 million tons produced in 2001. Campbell County coal production (12 active mines in 2002 and 11 active mines in 2001) increased by 1.0 percent (329.5 million tons to 332.8 million tons) from 2001 to 2002, and Converse County coal production (one active mine in 2001 and 2002) increased by 8.9 percent (24.6 million tons to 26.8 million tons) during the same time period. The combined 2002 coal production in these two counties was 96 percent of the state total (Wyoming Department of Employment 2001 and 2002).

In the second quarter of 2002, 29 percent of the total employment and 43 percent of the total payroll in

Campbell County were attributed to mining, which also includes oil and gas employment. During the same time period in Converse County, 8 percent of the employment and 12 percent of the payroll were attributed to mining (Wyoming Department of Employment 2003).

Approximate taxes and royalties from coal production in Campbell and Converse Counties are presented in Table 3-14. Following is a breakdown of each revenue source, in order from the largest total revenue producer to the smallest. The greatest source of combined state and federal revenue from Wyoming coal is the federal royalty. The current royalty rate for federal coal leases is 12.5 percent of the sales price, with half of this revenue returned to the state. At an estimated average sales price for PRB coal in 2002 of $5.55 per ton (WSGS 2003a), royalties were about $249.5 million.

Surface coal mines contribute 35 cents per produced ton to the AML program operated by the OSM, with half of this revenue earmarked for reclamation and other approved programs within the state. With 359.6 million tons of coal produced in Campbell and Converse Counties in 2002, AML contributions were about $125.9 million.

Severance taxes are collected by the state for removal or extraction of resources such as oil, natural gas, coal, and trona. The current Wyoming severance tax rate is seven percent of the state valuation of produced surface coal. The average valuation of coal produced during 1997 through 2001 in Campbell County and Converse County was $3.49 and $3.07 per ton, respectively (Wyoming Business Council 2003). Applying these average valuation rates to the 2002 coal production yields an estimated 2003 severance tax collection in the two counties of $87.1 million. The State of Wyoming retains approximately 83 percent of the severance tax, and the remainder is returned to cities, towns, and counties.

Lease bonus bids are one-time payments to the BLM for the right to enter into lease agreements for federal minerals. Bonus bids are paid in five annual installments, with half of each installment returned to the state. In the year 2002, bonus bid payments were made for two coal leases (North Jacobs Ranch and Horse Creek) and totaled $94.1 million (BLM 2003c).

Ad valorem taxes are collected by the county and disbursed to schools, cities, towns, the state foundation, and various other subdivisions within the county. Ad valorem taxes comprise production and property taxes, with production taxes being far greater than property taxes for surface coal mines. Production taxes are calculated as 100 percent of the state valuation of produced coal times the sum of mill levies for the production area. Property taxes are calculated as 11.5 percent of the property valuation at each mine times the mill levies. In recent years, Campbell and Converse County mill levies have averaged about 62 (Wyoming Department of Revenue

Table 3-14. Estimated 2003 Fiscal Revenues from 2002 Coal Production in Campbell and Converse Counties.

Revenue Item	Campbell County (millions of dollars)	Converse County (millions of dollars)
Federal Mineral Royalties	230.9	18.6
Abandoned Mine Lands Fund	116.5	9.4
Severance Tax	81.3	5.8
Bonus Bid Annual Revenues	90.1	3.9
Ad Valorem Tax	72.0	5.1
Black Lung Tax	73.9	6.0
Sales and Use Tax	6.3	0.2
Totals	671.0	49.0

2002). Production and property taxes paid by surface coal mines in the two counties in 2003 are estimated at $77.1 million.

The federal government levies a four percent tax on the sales price of all surface coal toward the Black Lung Disability Trust Fund. The estimated black lung taxes paid by coal mines in Campbell and Converse Counties for 2002 production total $79.8 million.

Sales and use taxes are distributed to cities and towns within each county and to the county's general fund. According to the Excise Tax Division of the Wyoming Department of Revenue (2003), the sales and use taxes collected from coal mines and coal mining-related services in Campbell and Converse Counties in FY 2003 were $6.6 million.

Additional sources of revenue include federal income tax and annual rentals that are paid to the federal government. The estimated total fiscal benefit to the State of Wyoming, including half of the federal mineral royalties, half of the AML fees, half of the bonus bid payments, and all of the ad valorem taxes, severance taxes, and sales and use taxes for coal produced in Campbell and Converse Counties in 2002 is $405.7 million, or $1.13 per ton. This agrees with an estimate previously proposed by the University of Wyoming of $1.10 per ton (Borden et al. 1994). Figure 3-24 depicts the estimated total revenues to state and federal governments from 2002 coal production in Campbell and Converse Counties.

Nationally, the minerals industry (including oil and gas) accounted for 1.3 percent of the GDP in 2001, and coal mining alone accounted for 0.1 percent (U.S. Department of Commerce 2003b). The most recent GSP calculations for Wyoming (2001) indicate that the minerals industry accounted for 23 percent of the GSP, which made it the largest sector of the Wyoming economy. Coal mining alone accounted for 5.4 percent of the Wyoming GSP (Wyoming Department of Administration and Information 2003a).

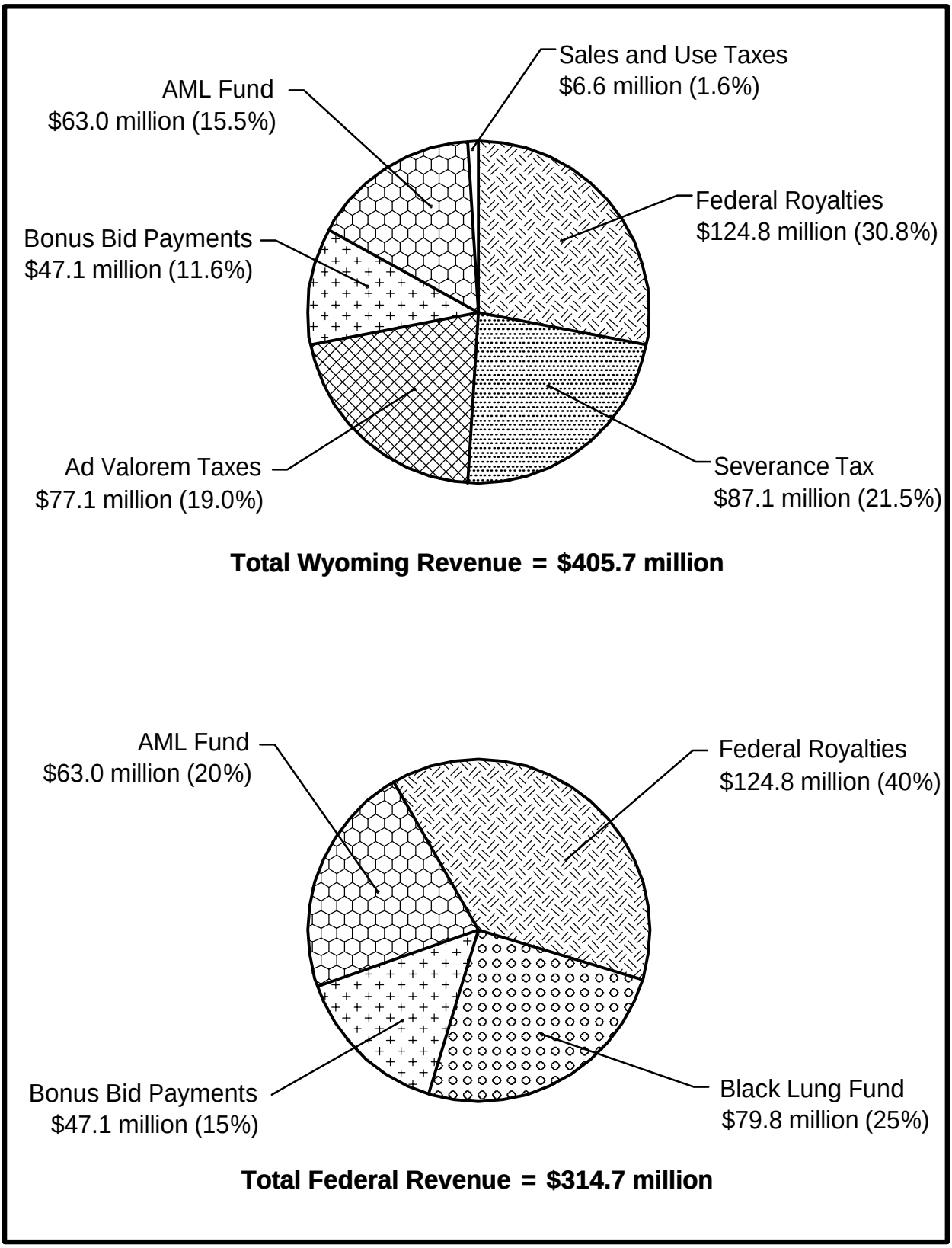

Figure 3-24. Estimated Wyoming and Federal Revenues from 2002 Coal Production in Campbell and Converse Counties.

3.18.3 Employment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s, declined during the 1980s, remained fairly constant through the 1990s, and gradually increased during the early 2000s. Since 1980, overall production has risen while employee numbers have generally decreased or remained constant. The employment decline followed large industry capital investments in facilities and production equipment, the majority of which were aimed at increasing productivity. There has been a recent upturn in Campbell County coal mining employment, where the number of employees increased from 3,011 to 3,580 from 1998 to 2002. Downsizing of the Dave Johnston Mine outweighed growth of the Antelope Mine and caused Converse County mining employment to decrease during the same time period from 337 to 315 employees (Wyoming Department of Employment 1998-2002).

In September 2003, the total labor force in Campbell County stood at 22,510 with an unemployment rate of 3.3 percent, which matched the unemployment rate in September 2002 (Wyoming Department of Employment 2003). In 2002, around 4,260 people were directly employed by surface coal mines or coal contractors, representing about 19 percent of the employed labor force (Wyoming Department of Employment 2002 and 2003).

The 2002 annual average employment in Campbell County of 22,026 set the all-time employment record. Prior to 2000, the Campbell County annual employment record was 19,128 and was set in 1982, a record year for mining employment. Total employment declined to a low of 14,288 in 1988, gradually increased during the 1990s, and sharply increased in the early 2000s. The current CBM development has resulted in a tight labor market for both skilled and unskilled labor; however, the mining industry has not had difficulty filling positions due to attractive wage and benefit packages and predictable schedules (Hockert 2000).

As of September 2003, the total Converse County labor force was 6,340 with an unemployment rate of 3.5 percent, compared to 4.0 percent in September 2002 (Wyoming Department of Employment 2003). In 2002, about 375 people, or 6 percent of the employed labor force, were employed by area coal mines or coal contractors (Wyoming Department of Employment 2002 and 2003). Total employment in Converse County declined from 7,710 in 1981 to a low of 4,845 in 1985. Employment gradually increased to 6,499 by 2000 and decreased in 2001 and 2002. Mining employment (include oil and gas workers) declined from 2,290 in 1980 to a low of 729 in 1990 and has slightly increased since that time.

3.18.4 Housing

The U.S. Census Bureau (USDOC 2003a) estimated 13,608 housing units in Campbell County in July 2002. This represents a 2.4 percent increase above the 13,288 housing units reported in the 2000 census and an 18 percent increase above the 11,538 housing units reported in the 1990 census. The number of housing units in Gillette, which is only reported in the biennial census, increased by 12 percent from 7,078 in 1990 to 7,931 in 2000.

Wright had 544 housing units during the 2000 census. This was a 3.2 percent increase over the 527 houses reported in the 1990 census.

According to the Wyoming Housing Database Partnership (2003), the average valuation of a single family housing unit in Campbell County in 2002 was $139,200, which was 6.1 percent higher than the average 2001 valuation.

Campbell County residential building permits rose from 15 in 1990 to 144 in 2002 (Wyoming Housing Database Partnership 2003). Due to population growth associated with CBM development, the housing vacancy rate in Gillette is low, with single family unit vacancy at nearly zero percent and apartment vacancy at 1.5 percent. Although several housing projects are on the horizon in the Gillette area, some new residents are currently unable to find rentals and are living in motels (Gillette News-Record 2002b).

The estimated number of housing units in Converse County in July 2002 was 5,718. This represents a 0.9 percent increase above the 5,669 housing units reported in the 2000 census and a 9.2 percent increase above the 5,234 housing units reported in 1990. Douglas had 2,385 housing units in 2000, which was a 5.2 percent increase above the 2,267 units reported in 1990.

In Converse County, residential building permits varied between zero and two per year from 1987 to 1990, rose to 27 in 1997, and fell to 16 in 2002 (Wyoming Department of Administration and Information 2003a). According to the 2000 census, Converse County contained 5,669 housing units, 2,385 of which were in Douglas. This represents a 5.2 percent increase over the 2,267 housing units reported in the 1990 census.

The average valuation of a single family housing unit in Converse County in 2002 was $109,900. The Converse County single family unit vacancy rate in 2002 was nearly zero percent, and the apartment vacancy rate was 2.4 percent (Wyoming Housing Database Partnership 2003). According to an area realtor, the tight housing market is typical in Douglas and may not be attributable to CBM development (Hollaway 2002).

According to a 2001 report on housing needs in Campbell County, roughly 61 percent of PRB surface coal mining employees live in Gillette and surrounding areas, 14 percent live in Wright, and 25 percent live

outside of Campbell County (Pedersen Planning Consultants 2001).

3.18.5 Local Government Facilities and Services

Gillette has generally maintained a steady population growth since 1987, when it totaled 17,054 (City of Gillette 2002). Owing to the substantial revenues generated by mineral production, local government facilities and services have kept pace with growth and are adequate for the current population. The opening of the South Campus of Campbell County High School has helped to alleviate overcrowding at the North Campus. South Campus opened in February 1999 with approximately 300 students and 22 teachers. The combined enrollment in both campuses for the 2003-2004 school year is approximately 1,500 students with 124 teachers (CCSD 2003).

The estimated 2002 population of Douglas (5,443) is lower than its peak of 7,800 in 1982, and local government facilities and services are generally adequate for the current population. The town has limited building space (platted lots) available for future growth. Some indoor recreational facilities may also be near capacity.

Wright was established in 1976 by the Atlantic Richfield Company and is the nearest community to the SPRB mines. Wright's population peaked in 1985 at approximately 1,800 and decreased to 1,285 by 1994. The estimated 2002 population of Wright was 1,427. As of October 2000, the town of Wright was not experiencing population growth due to CBM development (Buresh 2000). However, increasing CBM development and the construction of several proposed power plants in Campbell County will likely bring new residents to Wright (Pedersen Planning Consultants 2001). With the possible exception of residential housing units, Wright's infrastructure is more than adequate for the current and planned population, and with the current building going on it can double in population before services become limiting.

3.18.6 Social Conditions

Despite past boom and bust cycles in the area's economy, a relatively stable social setting now exists in these communities. Most residents have lived in the area for a number of years, social ties are well established, and residents take great pride in their communities. Many of the people place a high priority on maintaining informal lifestyles and small town traditions, and there are some concerns that the area could be adversely affected by more than a modest growth in population. At the same time, there is substantial interest in enhancing the economic opportunities available in the area and a desire to accommodate reasonable levels of growth and development.

Wyoming's economy has been growing steadily since reaching the bottom of an energy bust in 1987. The largest growth since the energy bust occurred in the early 1990s and

1999 to 2001, when the national economy was suffering. Conversely, the Wyoming economy grew slowly during the national economic boom of 1996 to 1998. As the national economy seems to be recovering in 2003, Wyoming's economy is slowing. The forecast is for slow growth through 2012. Wyoming population is projected to increase at approximately 0.5 percent per year. Non-agricultural employment has been projected to increase by an average of 1.0 percent through 2012 (Wyoming Department of Administration and Information 2003b).

Mining employment (including oil and gas) has been projected to remain approximately constant between 2003 and 2012. In 2002 there were 17,900 jobs in the mining sector in Wyoming. This number was down 2 percent from the 18,300 mining jobs in 2001. This small decrease was attributed to decreases in oil and gas jobs and in the support activities for mining (excluding oil and gas) (Wyoming Department of Employment 2003). Continued development of CBM resources in Wyoming may cause greater increases in mining sector employment through 2012 than previously estimated.

3.18.7 Environmental Justice

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", was published in the *Federal Register* (59 FR 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell and Converse Counties, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of coal mines within the General Analysis Area. Communities potentially impacted by the presence or absence of a coal mine have been identified in this section of the EIS. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with consultation and coordination described in Section 1.5 of this document. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.

3.19 Hazardous and Solid Waste

Potential sources of hazardous or solid waste on each of the five LBA tracts would include spilling, leaking, or dumping of hazardous substances, petroleum products, and/or solid waste associated with mineral, coal, oil and/or gas exploration and development, or agricultural or livestock activities. No such hazardous or solid wastes are known to be present on any of the five LBA tracts. Wastes produced by current mining activities at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines are handled according to the procedures described in Chapter 2.